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*Notified in G.Os. dated 30th June, 1942*

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# **Small Arms Training**

**Volume I, Pamphlet No. 7**

**303-inch Machine Gun**

**Part I.—Mechanical Subjects**

**1942**

(This pamphlet supersedes S.A.T., Vol. I, Pamphlet No. 7, Part I, mechanical subjects, 1939, and includes S.A.T. Vol. I, Pamphlet 7, Part I. (1939) Supplement)

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**GENERAL HEADQUARTERS (AUST.),**  
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CONTENTS

	PAGE
General—	
A. General principles .. .. .	1
B. Organization .. .. .	1
C. System of training .. .. .	2
D. Safety precautions .. .. .	6
Section 1. The gun and tripod—	
Lesson 1. General Description and demonstration of characteristics .. .. .	6
Section 2. Mechanism—	
Lesson 2. Backward movement.. .. .	12
" 3. Backward rotation of the crank .. .. .	13
" 4. Backward movement of the lock .. .. .	14
" 5. Forward movement of the lock .. .. .	16
" 6. Firing action .. .. .	16
Section 3. General maintenance of gun and tripod—	
Lesson 7. Cleaning .. .. .	18
" 8. Examination, tests and adjustments .. .. .	19
" 9. Examination, tests and adjustments— <i>continued</i> .. .. .	21
" 10. Preparation of gun and tripod for firing.. .. .	23
" 11. Points during firing.. .. .	25
" 12. Points after firing .. .. .	25
(Continued on page iii of cover)	

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This Pamphlet is drawn up to cater for the British Army organisation. Certain detail and equipment mentioned therein will not be applicable to Australian conditions.

## GENERAL

### A. GENERAL PRINCIPLES

1. Small Arms Training, Vol. I, Pamphlet No. 7, is arranged in three parts:—

Part I.—Mechanical subjects.

Part II.—Training.

Part III.—Fire control.

2. This pamphlet, Part I, deals with the technical training of machine gun platoons and sections.

3. The principles governing the tactical use of the .303-inch Vickers machine gun are dealt with in Field Service Regulations, Vol. II, Cavalry Training, and Infantry Training.

4. Instructions regarding the responsibility for the training of machine gun battalions is contained in Training Regulations.

5. The characteristics and elementary principles of handling machine guns are dealt with in Infantry Training, 1937, Sec. 4 and the Military Training Pamphlets concerned.

### B. ORGANIZATION

1. Within the machine gun battalion are four M.G. companies, each of three platoons.

The present Australian Infantry Battalion organization includes a Machine Gun Company, comprising a headquarters and three platoons, each of two sections.

2. The platoon is commanded by a subaltern, and consists of two sections, each of two guns.

In platoon headquarters, in addition to the commander, are:—

Platoon serjeant.

Platoon orderly (motor cyclist).

Batman.

Two scouts

Signaller

Driver-mechanic

Driver

} Australian organization.

3. The section consists of headquarters and two sub-sections each of six gun numbers, one of whom acts as driver to the truck.

In section headquarters are:—

Section commander.

Section corporal.

Range-taker.

Orderly.



4. The complete personnel, stores, equipment and ammunition of M.G. companies are carried in vehicles.

i. Company headquarters in trucks and lorries.

ii. Platoons in 6 trucks, sub-divided as under:—

Platoon headquarters .. 2 trucks.

Each section .. 2 trucks.

The distribution of personnel and stores of the M.G. platoon is set out in Sec. 15.

In the Australian organization, the distribution will be influenced by the type of vehicle allotted and the establishment laid down.

### C. SYSTEM OF TRAINING

1. **General.**—i. Before personnel can be considered individually fit to take their places in a M.G. platoon, they must first receive instruction in preliminary training.

It is essential that this training be continuous; where part only can be carried out at the depot, the remainder must be completed immediately after joining the battalion. This will probably necessitate centralization under battalion arrangements, the men not being posted to platoons until their preliminary training has been completed.

ii. On completion of the preliminary training period such personnel should receive further practice, as opportunity offers, in handling the gun as individuals and should complete their knowledge of mechanical detail. They will also begin training as members of sub-sections in section and platoon collective training exercises.

iii. Officers, N.C.Os., and potential N.C.Os., must receive instruction in fire control and leadership.

iv. Personnel of both section and platoon headquarters must receive instruction of their duties in the field.

This training of headquarters' personnel is an essential preliminary to the handling of sections and platoons in the field.

2. **Preliminary training.**—i. The table shown on p. 3 gives the subjects which must be taught in preliminary training. As a guide for organizing that training the course is shown divided into four stages, with a suggested number of hours for each lesson or group of lessons. The sequence of lessons in each stage should be arranged to suit local conditions.

The division into stages is not arbitrary, nor does it attempt to give a dividing line between depot and battalion periods.

ii. The practices of Part I, A.M.G.C., may be fired in any order and at such times as instructors consider that individuals have reached a sufficiently high standard of training.

They should not, however, be fired in one day.

#### PRELIMINARY TRAINING

Serial No.	Subject	Stages of training			
		1	2	3	4
		Hours	Hours	Hours	Hours
1	General description and 30-yds. range demonstration.	2			
2	Mechanism.	9			
3	General maintenance of gun and tripod.		Lessons 10, 11, 12.	Lessons 2, 3, 4.	Lessons 5, 6.
4	Stripping.		Lesson 15.	Lesson 16.	Lessons 17, 18.
5	Spare parts.	4	Lesson 20.		
6	Immediate action.	2	Lessons 23, 24.		
7	Instruments and aiming.	10		Lessons 34-38.	
8	Elementary gun drill.	12			
9	T.O.E.D.	15	Sec. 12.		
10	Part I, A.M.G.C.		Range course.		
11	Advanced M.G. handling.		Lessons 57-60.		
12	Vehicles.		Lesson 61.		
13	Visual training.		Lesson 63.		
14	Section drill.	6		Lesson 64.	
15	Platoon drill.			Lessons 65-72.	
16	Section drill night firing.				Lessons 73-83.
17	Observation of fire and ranging.				Lessons 84-87.
	Total hours	60	67	35	26

NOTE.—Sec. 13 (Signals) will be introduced as required during the training.



3. **Subsequent training of private soldiers.**—i. On completion of preliminary training private soldiers will be posted to platoons.

With the object of producing a higher standard of training, further practice in all subjects taught in preliminary training must be carried out, and, in addition, instruction must be given in mechanical subjects, such as special stoppages and causes of stoppages (Lessons 25 and 26), repairs (Lesson 27) and blank firing attachment (Lesson 28).

ii. They should be exercised in the field in section and platoon training exercises covering all tactical operations.

iii. Part I, A.M.G.C., should be fired during the weapon training year in which the men join their battalions, and after the completion of preliminary training. Men may also be required, if they have reached a sufficiently high standard of training, to fire Parts III and IV of the A.M.G.C.

iv. Part II, A.M.G.C., will be fired by the men in their second weapon training year if they have qualified in Part I.

v. Range-takers, orderlies and scouts, in addition to being trained as gun numbers, will require instruction in their special duties.

Range-takers will be trained in accordance with the instructions laid down in Pamphlet 10, and orderlies and scouts as specified in Infantry Training and Infantry Section Leading. Orderlies will also be trained to carry out certain technical duties in the field (*see* Sec. 22).

vi. All ranks, in addition to their training as machine-gunners, should receive instruction in driving mechanical vehicles.

The importance of training in tactical driving cannot be over-estimated.

vii. Judging distance tests will be carried out in accordance with Sec. 16.

4. **Officers and N.C.Os.**—i. A suggested course in fire control and leadership designed for junior officers and N.C.Os., with an allotment of hours to cover approximately three weeks, is set out below. The organization of this course should be centralized under battalion arrangements.

ii. In addition, officers and senior N.C.Os. should receive further instruction in:—

Directors .. ..	Lesson 39.
Slide rule .. ..	Lesson 40.
Plotter M.G. and Resector	
Protractor .. ..	Lesson 41.

Testing directors for angle of sight .. ..	Lessons 43 and 44.
Spotlight apparatus .. ..	Appendix I, Part II.
Night firing .. ..	Lessons 117, 118, 119, and 121.
Map shooting .. ..	Lesson 122.
T.O.G. .. ..	Lesson 123.
Fire direction and control charts .. ..	Lesson 124.
Safety calculated from the map .. ..	Lesson 132.

#### FIRE UNIT COMMANDER'S COURSE

Serial No.	Subject	Lessons	Hours
1	General principles.	Lessons 95-98.	5
2	Direct fire.	Lessons 99-105.	9
3	Indirect fire.	Lessons 106-116.	18
4	Night firing.	Lessons 117, 118, 119 (Lecture).	1
		Lesson 120.	3
5	Fire direction and control charts.	Lesson 124 (Lecture).	1
6	Flanking and overhead fire.	Lessons 125-131, 133.	13
7	Tactical lectures.	Platoon in attack.	1½
		Platoon in defence.	1
		Platoon in withdrawal.	1
8	Field duties.	Introductory (Sec. 22).	1
		Lessons 90-94.	9½
		H.Q. training (Sec. 21), lecture.	1
		Fd. duties exercises.	6
9	Miscellaneous.		
	i. Drills.	Method of conducting (Secs. 17, 18, 19).	1
	ii. Advanced M.G. handling.	Method of instructing, (Sec. 14).	2
	iii. Observation of fire and ranging.	Sec. 20.	2
	iv. Instruments.	Lessons 40, 42, 44.	2

Total 78

5. **Headquarters training.**—The action and duties of the personnel of platoon and section headquarters in coming into and out of action are laid down in Section 22. The procedure must be applied to each case according to the tactical situation, the role given to the platoon and the ground.

Before starting collective training, platoon and section headquarters should be thoroughly grounded in this procedure



by means of exercises without the gun numbers, both on the sand table and on the ground. This training can be carried out at a time when the remaining personnel of the company are otherwise employed.

The method of instruction is contained in Secs. 21 and 22.

#### D. SAFETY PRECAUTIONS

On all occasions when the gun and dummy cartridges are used for instructional purposes, the instructor will carry out the following safety precautions:—

- i. Inspect all locks to ensure that the striker does not protrude through the firing pin hole.
- ii. Inspect all ammunition to ensure that all cartridges are dummies.

Note 1.—When instruction is being given in mechanical subjects, D.P. stores, if available, will always be used.

2. When service stores are used i. above does not apply.

### SECTION 1—THE GUN AND TRIPOD

#### LESSON 1—GENERAL DESCRIPTION AND DEMONSTRATION OF CHARACTERISTICS

##### *Instructor's Notes*

##### *Stores.—*

Gun, tripod, ammunition box, belt and dummy cartridges, spare parts case, condenser can and tube, gun chest, spare barrel, cleaning rod. Diagram if available. Blast deflector.

Do not expect the man to remember the names of all the parts. Only mention the names of the main parts of the gun and tripod, and point out these as they are named.

Strip the gun down and show the parts affected by recoil.

Give a brief outline of the functions of these parts.

Emphasize the strength of all parts.

Use diagrams (if available) when explaining the water cooling system.

Demonstration of characteristics should follow immediately the general description.

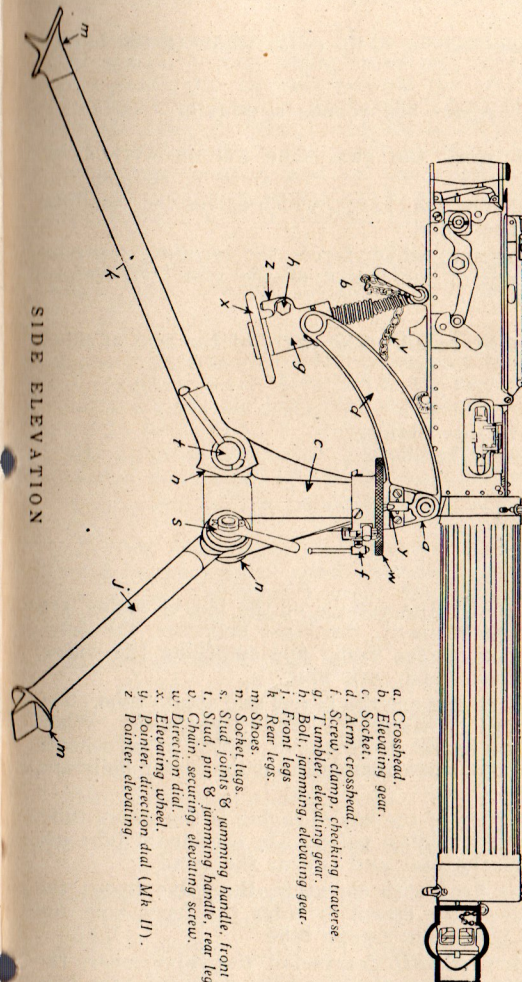


PLATE I  
MOUNTING, TRIPOD, 303-IN., M.G. MARK IV.



## A. GENERAL DESCRIPTION (PLATE 1)

1. **Name of gun.**—The 303-inch Vickers Machine Gun.
2. **Weight of gun.**—About 40 lb. (with water in the barrel casing).
3. **Rate of fire.**—About 500 rounds a minute.
4. **Forces which work the gun.**—The gun is worked by two forces:—
  - i. The explosion of the charge, which drives the recoiling portions back, and
  - ii. The fusee spring, which forces the recoiling portions forward again; the action of the gun is therefore automatic.
5. **Parts affected by recoil.**—The parts of the gun affected by recoil are:—
  - Muzzle cap.
  - Barrel.
  - Right and left side plates.
  - Crank and crank handle.
  - Fusee.
  - Fusee spring.
  - Connecting rod.
  - Lock.
  - Feed block.

6. **Barrel casing.**—On the outside of the barrel casing are fitted the muzzle attachment, the blast deflector, the foresight, two screwed plugs for filling and emptying the water, adapter for condenser, and cork plug.

Inside the barrel casing are the barrel and steam tube. The barrel is surrounded by water for cooling purposes. When the gun is fired, the barrel becomes hot, which in turn heats the water. After about 500 rounds rapid the water boils and gives off steam.

Inside and at the top of the barrel casing is the steam tube, which is fitted with a sliding valve. On the steam tube are three holes, one at the rear and two at the front.

When the gun is fired with elevation, the valve covers the rear hole, and allows the steam to enter the front hole and pass out through the steam escape tube.

When the gun is fired with depression, the valve covers the front hole, thereby allowing the steam to enter the rear hole and again pass out through the steam escape tube.

Fitted to the adapter is the condenser tube, which carries the steam from the steam escape tube into the condenser can.

In order to condense the steam, the condenser can must be about two-thirds full of water and the end of the condenser tube placed below the level of the water.

7. **Breech casing.**—The breech casing consists of two outside plates, bottom plate, front and rear covers, and rear cross-piece. On the left side of the breech casing are the fusee spring and box, a bracket with fittings for the dial sight, and left slide; on the right side the check lever and right slide. On the rear cover is the tangent sight; on the bottom plate the sliding shutter, and on the rear cross-piece are the traversing handles, safety catch, and thumb-piece. The rear cross-piece is held in position by the T fixing pin.

8. **Feed.**—The gun is fed by a belt containing 250 rounds, which passes through the feedblock from right to left.

9. **Tripod.**—The tripod consists of three legs with jamming handles, cross-head, socket, traversing clamp, direction dial, and elevating gear. Attached to the crosshead are the cross-head and elevating joint pins, by means of which the gun is fixed to its tripod.

Elevation or depression is obtained by the elevating gear, direction maintained by the traversing clamp.

The weight of the tripod is about 50 lb.

10. **Gun chest.**—For the purpose of transit the gun is placed in the wooden chest provided, which also carries the cleaning rod and spare barrel. The blast deflector is put on the strap of the spare parts case.

11. **Demonstrate, with brief explanation.**

- i. Method of inserting rounds in belt.
- ii. How the gun is loaded (gunner acting alone).
- iii. How the gun is held and fired.
- iv. How the gun is unloaded (gunner acting alone).

Practice men in above actions.

## B. DEMONSTRATION OF CHARACTERISTICS

1. **Main characteristics.**

- |   |   |       |
|---|---|-------|
| <ol style="list-style-type: none"> <li>(1) Concentrated.</li> <li>(2) Volume</li> <li>(3) Accurate</li> <li>(4) Sustained</li> <li>(5) Ranges beyond those effective for rifles and light machine guns.</li> <li>(6) Small target while in action.</li> </ol> | } | Fire. |
|---|---|-------|



## (7) Able to fire:—

- (a) Over heads of own troops.
- (b) Indirect.
- (c) Blinded by smoke, etc.
- (d) By night, if daylight preparation made.

## Due to:—

Fixed mounting.  
Strong mechanism.  
Belt feed.  
Water cooling.

*Demonstration.*

- i. Effect of mounting tripod on soft ground.  
Lesson.—Stamp in tripod legs, when tactical situation allows.  
Occasionally relay between bursts.
- ii. Concentrated nature of fire unaffected by human element (fired with punch).  
Lesson.—Provided that sights set correctly and gun laid accurately, tired men will produce fire effect.
- iii. Defective tripod.  
(Loose jamming bolt causing elevating wheel to rotate.)  
Lesson.—Elevating wheel sticky.  
Occasionally relay between bursts.

**2. Rates of fire.**

Normal .. .. 1 belt in about 2 minutes. This rate can be maintained indefinitely without undue strain on guns or personnel. It may be suitably employed in the neutralization of areas within which the enemy is suspected.

Rapid .. .. 1 belt in about 1 minute. The availability of ammunition and the strain on guns and personnel will limit the length of time during which this rate of fire can be maintained. It will be employed in engaging vulnerable or fleeting targets and may form part of neutralization and harassing fire tasks.

NOTE.—For harassing fire tasks the requirements of machine guns is intermittent fire over a period of time, opened at irregular intervals at normal and rapid rates, with a view to maximum effect from a relatively small expenditure of ammunition.

*Demonstration.*

- i. Rates of fire.—Rapid— $\frac{1}{2}$  belt.  
Normal— $\frac{1}{2}$  belt.
- ii. Flexibility (three widely dispersed plates on butts).  
M.G. (firing direct) very flexible.  
N.B.—No. 2 helps No. 1 by loosening clamp.
- iii. Swinging traverse.  
Favourable targets under about 400 yards' range.  
N.B.—Clamp fairly sticky.

**3. Disadvantages.**

Mechanical breakdown	..	Care and training.
Steam	.. ..	Condenser.
Smoke	.. ..	Other smoke in war.
Noise	.. ..	Deceptive.
Muzzle blast	.. ..	Wet sandbags, groundsheet.
Flash	.. ..	Screen from flanks.

*Demonstration.*

Muzzle blast—Gun mounted over dusty patch with and without blast deflector.  
Lesson—avoid dust;  
put down wet sandbags, etc.

NOTE 1.—On conclusion of this demonstration, each man under instruction should fire the "Introductory Practice" laid down; the Instructor demonstrating the actions specified under (ii), (iii) and (iv) in para. 11, before exercising his squad. The direction and elevation of the gun to be controlled by the Instructor.

**SECTION 2—MECHANISM***Instructor's Notes**Stores for Lessons 2—6:—*

Gun, tripod, spare parts case, ammunition box, belt and dummy cartridges, empty cartridge case, spare feedblock, skeleton lock, diagrams.

The preparation paragraph affects the instructor only.

Imitation will not be carried out by the private soldier.

When explaining any mechanical movement, show it by means of demonstration, combined with explanation.

Use diagrams to assist.

**General**

The gun during firing follows a definite cycle of operations, and assuming the gun to be fully loaded, i.e. the first round in the chamber and the second engaged by the extractor in



the feedblock, the following action will take place when the thumbpiece is pressed.

## LESSON 2

### A. Firing action first shot

*Method of instruction.*

#### 1. To set up the gun:—

Load.

Raise rear cover.

Remove trigger bar.

Place trigger bar over trigger and trigger bar lever.

#### 2. Control the trigger bar, press the thumbpiece and explain:—

(Using the gun.) The safety catch being raised and the thumbpiece on the firing lever pressed, the pawl near the bottom of the firing level pushes forward the bottom of the trigger bar level which, being pivoted in the centre, causes the top to come to the rear, engaging a projection on the trigger bar and drawing it to the rear. As the trigger bar is withdrawn the front end of the slot engages the tail of the trigger (using skeleton lock), thereby releasing the nose of the trigger from the bent of the tumbler. The long arm of the lock spring then propels the firing pin on to the cap of the cartridge and fires the charge.

### 3. Interrogation

### B. Action on recoil

*Method of instruction.*

#### 1. To set up the gun:—

Place an empty case between the upper and lower projections of the gib.

Half load: press thumbpiece.

Remove the fusee box and spring.

Raise the rear cover.

Remove the outer casing muzzle attachment.

Remove the right slide.

#### 2. Push back the recoiling portions from the front and explain:—

The explosion will cause the recoiling portions to move backward through a distance of about 1 inch, thereby extending the fusee spring.

This backward movement is due partly to recoil, and partly to the effect of the muzzle-attachment, which acts as follows: the powder gases which escape through the muzzle after the

exit of the bullet strike violently against the front cone, and rebound on to the front face of the muzzle cap, thereby assisting to drive the recoiling positions backward. The gases then escape through the vents in the outer casing.

### 3. Interrogation

### C. First action in the feedblock

*Method of instruction.*

#### 1. To set up the gun:—

Place an empty case between the upper and lower projections of the gib.

Half load: press thumbpiece.

Raise the front cover.

Remove the outer casing muzzle attachment.

Remove fusee box and spring.

Prepare spare feedblock by placing a dummy cartridge in front of the bottom pawls.

#### 2. Push back the recoiling portions from the front, and explain, using gun and spare feedblock or diagrams:—

As the recoiling portions travel backward, the recess in the prolongation of the left side-plate carries with it the stud on the bottom lever of the feedblock. The bottom lever, acting on the top lever, causes the slide and the top pawls to move to the right, enabling the top pawls to engage behind the cartridge already held in position by the bottom pawls.

### 3. Interrogation.

## LESSON 3

### A. Backward rotation of the crank

*Method of instruction.*

#### 1. To set up the gun:—

Place an empty case between the upper and lower projections of the gib.

Half load: press thumbpiece.

Remove fusee box and spring.

Raise rear cover.

Remove the outer casing muzzle attachment.

#### 2. Push back the recoiling portions from the front until the crank handle is vertical, and explain:—

The backward movement of the recoiling portions causes the tail of the crank handle to roll on the roller, thereby rotating the crank. The rotation of the crank draws back the lock, and causes the fusee to wind the fusee chain, thus further extending the fusee spring.



Complete the movement by pressure on the knob of the crank handle and continue:—

Owing to the momentum of the lock, connecting rod, crank, and crank handle, the crank handle continues to roll against the roller. This rolling of the crank handle, assisted by the fusee spring, forces the whole of the recoiling portions forward again, with the exception of the lock, which continues its backward movement for a short distance before it joins in the forward movement.

### 3. Interrogation.

#### B. Second action in the feedblock

##### *Method of instruction.*

##### 1. To set up the gun:—

Half load.

Remove fusee box and spring.

Pull back recoiling portions until crank handle is vertical.

Raise front cover.

Prepare spare feedblock by placing a dummy cartridge in front of the bottom pawl, and the slide over to the right.

2. Force the recoiling portion forward by rolling the crank handle on the roller, and explain, using gun, spare feedblock, or diagrams:—

As the recoiling portions go forward, the recess in the prolongation of the left side-plate carries with it the stud on the bottom lever of the feedblock. This bottom lever, acting on the top lever, moves the slide and the top pawls to the left, the pawls thus bringing the cartridge in the belt to a position against the cartridge and bullet stops, ready to be gripped by the extractor. The belt, as it moves to the left, slides between the bottom pawls, which are depressed as the cartridge passes over them; the pawls rise behind the fourth cartridge, hold the belt in position, and prevent it from sliding back after the third cartridge has been withdrawn by the extractor.

### 3. Interrogation.

## LESSON 4

#### A. Backward movement of the lock

##### *Method of instruction.*

##### 1. To set up the gun:—

Place an empty case between the upper and lower projections of the gib.

Half load: press thumbpiece.

Remove fusee box and spring.

Raise rear cover.

Prepare spare lock.

2. Draw the lock backwards by rolling the crank handle on the roller and explain, using gun and spare lock or diagrams:

As the lock moves backward, the extractor withdraws the live round from the feedblock and the empty case from the chamber. The horns of the extractor move along the surface of the cams until the cartridge is clear of the belt. When the extractor arrives at the end of the cams it is forced down by the ramps on the cover, thus bringing the cartridge drawn from the feedblock into line with the chamber, and probably causing the empty case drawn from the chamber to fall off. The live cartridge is prevented from slipping down the face of the extractor by the bottom projection of the gib. (If the empty case does not fall off when the extractor drops, it will be forced off as described in the forward movement of the lock.)

#### B. Cocking action of the lock

##### *Method of instruction.*

##### 1. To set up the gun:—

Place an empty case between the upper and lower projections of the gib.

Half-load: press thumbpiece.

Remove fusee box and spring.

Raise rear cover.

Prepare skeleton lock.

2. Pull the crank handle on to the roller and with gun and skeleton lock or diagrams explain:—

The rotation of the crank gives an upward motion to the connecting rod and side lever head, the latter, bearing on the tail of the tumbler, rotates the tumbler on its axis, and forces the firing pin to the rear. The long arm of the lock spring acts on the projection of the firing pin, whilst the short arm bears against the nose of the trigger; consequently the withdrawal of the firing pin compresses the lock spring. As the tumbler further rotates, the short arm of the lock spring forces the nose of the trigger over the bent of the tumbler and carries the firing pin still further to the rear, thereby allowing the sear to rise, due to the action of the sear spring, and its bent to engage the bent on the firing pin. The firing pin is thus prevented from flying forward.

### 3. Interrogation.



## LESSON 5

## Forward movement of the lock

## 1. To set up the gun:—

Half load.

Remove fusee box and spring.

Pull the crank handle on to the roller and pull the belt.

Raise the rear cover.

Prepare spare lock.

## 2. Force the crank handle on to the check lever and explain, using gun and spare lock or diagrams:—

When the force of the explosion is expended, the fusee spring takes command, and unwinding the fusee chain from the fusee gives a rotary movement to the crank. This imparts a forward and downward action to the connecting rod and side lever head, thereby causing the lock to continue its forward movement.

As the lock travels forward, the extractor places the live round in the chamber, and is moved upward by the side levers acting on the extractor levers. The bottom projection of the gib slides over the base of the live cartridge in the chamber and the top projection of the gib slides over the base of the cartridge which has been moved into position in the feed block. The firing pin hole is thus brought opposite the cap. As the extractor rises, the empty case, if it has not already fallen off, will be forced off by the seating for ejection.

As soon as the extractor reaches its highest position, the side-plate springs engage in grooves in its sides. (This prevents the horns from falling and fouling the front end of the solid cams in the breech casing at the beginning of the backward movement when there are no cartridges on the face of the extractor.) The further movement of the connecting rod and side lever head causes the lock to be forced slightly farther forward, and the breech is then closed. During this movement, the steps on the side levers travel over the bents on the extractor levers.

## 3. Interrogation.

## LESSON 6

## A. Firing action subsequent shots

*Method of instruction.*

## 1. To prepare the gun:—

Load.

Raise rear cover.

Remove trigger bar, and place it over the trigger bar lever and trigger.

## 2. Controlling the trigger bar, draw back the lock, allow it to go forward slowly and explain:—

(Using gun.) The firer, by maintaining pressure on the thumbpiece, holds back the trigger bar; therefore, each time the lock goes forward, the front end of the slot holds back the tail of the trigger before the lock is quite home.

(Using skeleton lock.) By this means the nose of the trigger is prevented from engaging in the bent of the tumbler. When the lock is home, the side lever head depresses the sear, thus allowing the long arm of the lock spring to carry the firing pin on to the cap, and fire the charge.

The depression of the sear is so timed that the firing pin cannot be released until the lock is in the firing position.

## 3. Interrogation.

## B. Action inside lock when pressure is released from the thumbpiece

*Method of instruction*

## 1. To set up the gun:—

Load.

Raise the rear cover.

Remove the trigger bar, and place it over the trigger and the trigger bar lever.

Control the trigger bar and press the thumbpiece.

## 2. Release pressure on thumbpiece and explain:—

(Using the gun.) On releasing pressure on the thumbpiece the trigger bar is allowed to resume its normal position.

(Using the skeleton lock.) The short arm of the lock spring forces the nose of the trigger over the bent of the tumbler so that, when the sear is depressed, the nose of the trigger engages in the bent of the tumbler, and the firing pin is unable to go forward.

## 3. Interrogation.

## SECTION 3 — GENERAL MAINTENANCE OF GUN AND TRIPOD

1. Care and cleaning of the gun is of the utmost importance in order that the gun may fulfil any task demanded of it.

2. Machine guns and equipment should be examined when first taken over. Further frequent examinations will also be necessary.



*Instructor's Note**Stores for Lessons 7-12.—*

*Gun, tripod, ammunition boxes, belt with dummy cartridges, spare parts box and case, condenser can and tube, cleaning rod, flannelette, and old linen.*

## LESSON 7—CLEANING

**1. Daily cleaning.**—The outside of the gun will be cleaned daily, and all parts of the mechanism which can be reached without stripping will be wiped over with an oily rag. The inside of the barrel will be left oily. On completion of daily cleaning the gun will be inspected both for cleanliness and damage. In examining the barrel the mirror reflector will be used.

To clean the barrel.—Take out the lock, take off the muzzle attachment and muzzle cup. Place a piece of dry flannelette (4 by 2) in the eye of the cleaning rod and insert it into the muzzle end of the barrel. Ensure that the bush is over the muzzle, and move the rod backwards and forwards. Repeat with fresh pieces of flannelette until the barrel is clean.

To oil the barrel.—Repeat the above with a smaller piece of flannelette well soaked in oil.

To use the double pull-through.—Before use it is essential to see that the weight is not bent and that the cord is in good condition. Ensure that the gauze is thoroughly oiled and that the muzzle protector is placed on the barrel. The barrel may either be left in the gun or taken out for the purpose of cleaning. If left in the gun, proceed as follows:—

Take out the lock. Take out the elevating joint pin and depress the gun. Pass the pull-through from the breech end through the barrel. Lower the rear cross-piece. Replace the elevating joint pin. Pass the loop end on the pull-through under the crank and replace the lock in the "Clear Gun" position. The pull-through is then pulled backwards and forwards through the barrel. Care must be taken to keep the cord taut and prevent wear on the breech end of the barrel.

If the barrel is removed from the gun for cleaning, it should be fixed in a suitable vice or held firmly by a man.

An effective means of cleaning the barrel is with boiling water. Having removed the barrel from the gun, adopt the same procedure as used in cleaning the rifle (see Pamphlet No. 3, page 15).

**NOTE.**—The use of the service "anti-corrosive" oil (when available) will normally obviate the continual cleaning with the double pull-through, or boiling water.

**2. Weekly cleaning.**—The gun will be stripped down and all parts cleaned and left dry for inspection. Where the bore has become rusty, it should be wiped out with flannelette;

boiling water should then be used, and, finally, the barrel cleaned with the double pull-through.

After inspection the gun will be oiled before being put away.

Spare parts and stores will also be examined and checked.

## LESSON 8—EXAMINATION, TESTS AND ADJUSTMENTS

**1. Muzzle attachment.** Free from fouling and burrs, disc cleaned, split pin and chain in good condition. Blast deflector fitted correctly.

**2. Muzzle cup.** Clean, threads neither damaged nor badly worn.

**3. Steam tube.** Keeper screw in correct position, sliding valve working. (To test this, take the gun off the tripod and give it a rocking movement. The movement of the valve should then be heard.)

**4. Foresight.** Blade in good condition.

**5. Front cover catch.** Working correctly.

**6. Fusee spring and fusee.** Claws of spring, fusee and chain in good condition. Vice pin not bent.

Instructions for weighing and adjusting the fusee spring.

Take out the lock and place the loop of the spring balance over the knob of the crank handle. Pull the balance vertically upwards, resting the wrist on the breech casing. The reading indicated when the crank handle begins to move will be the weight of the fusee spring. This weight should be between 7 and 9 lb. If the spring is over, or not up to, weight, adjust by means of the vice pin. Generally six clicks (three revolutions) makes a difference of about 1 lb. Turning the vice pin upwards decreases the weight and vice versa. The tension of the fusee spring should always be kept as high as possible, consistent with maintaining the normal rate of fire of about 500 rounds a minute.

**7. Tangent sight.** Apertures in good condition. Top and bottom screws secure. Slide moving freely.

**8. Rear cover lock.** Automatic fastening of rear cover when down. Cover lock screwed axis pin, screwed fully home.

**9. Safety catch.** Automatic action of spring.

**10. Firing lever.**—

i. Thumbpiece cannot be pressed in unless safety catch is raised.

ii. When safety catch is raised and thumbpiece pressed lock is fired.



11. Trigger bar and spring. No burrs or roughness on trigger bar. Spring forces trigger bar forward quickly.

12. Recoiling portions. Remove the fusee spring and work the recoiling portions backwards and forwards. They should move freely.

Instructions for weighing the recoiling portions.—

Remove the fusee spring. Place the crank handle nearly vertical. Place the loop of the spring balance over the right end of the crankshaft and pull slowly to the rear. Immediately the recoiling portions begin to move read the weight shown on the spring balance. The weight should not exceed 4lb.

If the weight exceeds 4lb., this is probably due to tight packing. This can be reduced by well oiling the packing in the cannellure and gland, and moving the recoiling portions sharply backwards and forwards. Re-weigh and repeat the above as necessary. If, however, it is found that the necessary reduction in weight cannot be achieved by this means, examine the gun for damaged breech casing or side plates.

13. Connecting rod. Adjusting nut tight.

14. Lock. Instructions for testing the lock.

i. *Side and extractor levers.*—Remove the feedblock and keep the front cover raised. Draw back the crank handle and let it go slowly forward on to the check lever. If correct, the extractor should now be in its highest position.

ii. *Bents of sear and firing pin.*—Remove the feedblock and keep the front cover raised. Pull the crank handle on to the roller, press the thumbpiece and, while maintaining pressure, let the crank handle go slowly forward on the check lever. The extractor should be kept up to its highest point before the sear releases the firing pin.

iii. *Extractor.*—Remove the lock, examine the face for burrs and flaws.

iv. *Nose of trigger and bent of tumbler.*—Cock the lock, release the sear; the firing pin should now be held back.

v. *Firing pin.*—See that the point is not broken. A broken firing pin can be recognized without stripping the lock by releasing the lock spring with the extractor up. If correct, the firing pin will then protrude from the firing pin hole, and can be withdrawn by raising the tail of the tumbler. If it does

not protrude, or if protruding but the point is not withdrawn when the tail of the tumbler is raised, some part of the firing pin is broken.

Instructions for testing the weight of the lock spring.—

Fully cock the lock. Place the bottom of the lock on a flat surface. Place the loop of the spring balance over the side lever head and left hand on the top of the lock. Draw the side lever head upwards with the spring balance; immediately the tumbler begins to rotate the balance should record from 12 to 14 lb.

## LESSON 9—EXAMINATION, TESTS AND ADJUSTMENTS—*continued*

1. Barrel. The barrel should be carefully examined for rust, cuts, erosion, cord-wear, bulges and metallic fouling.

Proceed as follows:—

Remove the barrel from the gun. First with the eye close to the breech, then with the eye some inches back from the breech, examine the bore, rotating the barrel slowly. Carefully examine the lead to see if undue erosion has taken place.

The barrel should now be reversed and examined carefully from the muzzle end in a similar manner.

Inaccuracy in shooting may be due to the presence of metallic fouling.

Instructions for the renewal of packing.—

i. To renew packing at the breech end of the barrel.—

Should the gun leak at the breech, empty the barrel casing. Draw out the recoiling portions. Wind a strand of asbestos in the cannellure of the barrel, pressing it together with a thin piece of wood or the point of a screwdriver or knife, until the cannellure is full. Then smooth the asbestos down flush with the barrel, oil it and re-assemble the parts.

ii. To renew packing at the muzzle end of the barrel.—

Should the gun leak at the muzzle, stand the gun on the rear cross-piece, remove the muzzle attachment, and unscrew the gland. Re-pack, or, if necessary, replace the asbestos, having first oiled it, by winding it loosely round the barrel, and, while winding, push it in with a No. 3 punch, piece of wood, or any blunt-ended instrument that will fit; screw on the gland as tightly as can be done by hand, return the gun to a horizontal position, hang



the lock and work the recoiling portions backwards to ensure that they move freely. If the packing is found to press too hard on the barrel, the gland should be removed and one or two strands of asbestos taken out.

Finally, see that the gland is screwed firmly home by means of the combination tool.

To test packing.—

Fill the barrel casing with sufficient water to cover the barrel, and work the recoiling portions backwards and forwards. There should be no leakage.

Test the recoiling portions for correct weight.

2. Feedblock. Slide working freely; pawls and springs in good condition.

3. Sliding shutter. Catch and spring working automatically.

Sliding shutter working freely. If the movement of the sliding shutter is sticky, examine for:—

i. Dirt or grit.

ii. Dented bottom plate, due to connecting rod being dropped when no lock is in the gun.

4. Axis and other pins. See that all pins are correct.

5. Tripod. There are many places where slight play, caused by wear, may occur. Although the play in each particular part may be very slight, the accumulated effect may cause serious unsteadiness in the gun.

Vertical play. Usually found in the elevating gear. This may be taken up by loosening the jamming bolt, screwing in the tumbler nut, and re-tightening the jamming bolt.

Lateral play. Usually due to the jaws of the cross-head having become widened.

Further points for examination:—

i. Clutch plates free from grit.

ii. Jamming handles not bent.

iii. Chains correct.

iv. Feathers on joint pins.

6. Belt and belt boxes.

Belts. Free from dirt; brass strips correct, neither torn nor frayed.

Belt boxes. Clean and undamaged,

## LESSON 10 — PREPARATION OF GUN AND TRIPOD FOR FIRING

1. Strip the gun down.

2. Examine and clean all parts.

3. Oil the outside of the barrel.

4. Re-assemble the gun.

5. Dry the inside of the barrel, muzzle cup, muzzle attachment and blast deflector.

6. Muzzle cup to be firmly screwed on.

7. Level the gun, fill the barrel casing with water by removing the screwed plug at the breech end, and the cork plug.

8. Oil (*see* Note 3).—

i. Recoiling portions (including the face of the lock).

ii. Ramps.

iii. Trigger bar.

9. Weigh.—

i. Fusee spring.

ii. Recoiling portions.

iii. Lock spring.

10. Traversing handles and can in spare parts case filled with oil.

11. Check the contents of the spare parts case and box.

12. i. Examine the condenser tube for damage.

ii. Test the fitting of the condenser tube to the gun.

13. Condenser can to be two-thirds full of water.

14. Spare barrel packed, ready for firing, and cleaning rod placed in gun chest.

15. Examine the tripod.

NOTE.—1. Action in cold weather. Keep the friction of the recoiling portions as low as possible, i.e. between two and three lb., and adjust the weight of the fusee spring to not more than seven lb. at the start. Remove all old oil from the lock and keep the front face and slide of the extractor, also the extractor levers, free from oil. Wrap straw, sacking or



blankets round the barrel casing. Work the recoiling portions by hand at frequent intervals.

2. Action in sandy countries. Ensure that only a small quantity of oil is used.

Working parts wiped over with a slightly oily rag will prevent rust through the night, and will be sufficient lubrication for working the gun during firing.

3. As the prevailing conditions in Australia are tropical, sub-tropical and normal, graphited grease is to be used as a lubricant for machine guns.

Certain parts of the weapon, as detailed below, will be very lightly lubricated with graphited grease, instead of G.S. oils, before firing. Parts so treated will be thoroughly cleaned and dried before application of the graphited grease. The procedure applies under conditions of normal as well as extreme heat.

Graphited grease will be used for the lubrication of all sliding parts and frictional surfaces. Pins and other parts which are, comparatively speaking, inaccessible, will be lubricated with either of the G.S. oils (M 80 or Oil "A"). Common sense must be exercised in this respect, e.g. the internal parts of locks must not be lubricated with the graphited grease.

On active service, or before firing, parts will be lubricated with graphited grease as above. All other parts which require lubrication before firing will be lubricated with either of the G.S. oils available in accordance with the usual procedure. When the gun is not prepared for firing, or in transit, or unlikely to be used, it will be lubricated with one of the G.S. oils in accordance with the existing procedure.

Graphited grease will be carried in "Bottles, oil," each containing approx.  $\frac{1}{2}$  oz. The bottle will be carried with the spare parts immediately available to the gun.

Under conditions where dust and sand are plentiful, the working parts will be cleaned as often as possible, and the graphited grease very lightly applied. No oil will be used, as this merely serves to collect the dust or sand and helps to clog the mechanism. Failing a supply of graphited grease it is better to use no lubricant at all rather than use oil. (M.B.I. 018/1941.)

## LESSON 11 — POINTS DURING FIRING

1. Watch the water supply. (As soon as the water begins to boil, and so long as it continues to boil, about  $1\frac{1}{2}$  pints will be lost for every two belts fired.)

2. Ensure that the belt—

- i. Is kept in line with the feedblock.
- ii. Has free movement.

3. See that all repairs are carried out immediately.

Lock repairs.—To replace any part of the lock, the ordinary sequence for stripping the lock must be followed, until the required part is reached.

In the case of a lock spring, where the broken portions fall clear, a new lock spring may be assembled without stripping the lock.

4. During a temporary cessation of fire (see Note 3 above)—

- i. Oil up:—bearing parts of barrel;  
recoiling portions (except muzzle cup);  
ramps;  
trigger bar.
- ii. Ensure that the front cone, muzzle cup and jamming handles are tight, and that the end of the condenser tube is in the condenser can below water level.

5. Anti-gas measures.

See Pamphlet, No. 3, Lesson 4.

## LESSON 12 — POINTS AFTER FIRING

1. On the range—

- i. Unload, remove the lock, blast deflector, muzzle attachment, and muzzle cup.
- ii. Clean the barrel of superficial fouling with the cleaning rod and oiled flannelette, followed by dry flannelette.



- iii. Use the double pull-through to remove any metallic fouling which is still left in the barrel.
- iv. Re-oil the barrel with the cleaning rod.
- v. Oil the muzzle cup, muzzle attachment, lock, and blast deflector.
- vi. Re-assemble the gun.
- vii. Short live rounds from empty cases.

NOTE.—It may assist in the cleaning of the barrel on return to barracks if the water is left in the barrel casing.

## 2. On return to barracks—

- i. Strip the gun and thoroughly clean all parts.
- ii. Release tension from the fusee spring.
- iii. Pour boiling water through the barrel, and then, if necessary, use the double pull-through.  
(See Note, Lesson 7.)
- iv. In order to prevent the formation of rust on the exterior of the barrel due to condensation of moisture, completely empty the barrel casing, and remove the screwed and cork plugs to permit the free circulation of air through the casing. If the gun is likely to be so left for any length of time, remove the asbestos packing from the canelure and gland.
- v. Clean and overhaul the tripod, spare parts and ammunition.
- vi. If belts with strips are used.
  - (a) Belts:—Dry wet belts.  
If dirty or greasy, clean by soaking for two hours in a solution consisting of:—  
One part soda.  
Three parts soft soap.  
Ten parts water.  
After soaking scrub, and when dry, plug the belts with the belt plug. Care must be taken in using the belt plug, or loose pockets will result.
  - (b) Belt boxes.—Remove all dirt and mud, and wipe over the outside with an oily rag.

## SECTION 4 — STRIPPING

### *Instructor's Notes*

#### *Stores.—*

*Gun, tripod, spare parts case, and box.*

- i. Lay emphasis on the "Points to be observed" section.
- ii. The squad should be proficient in Lessons 13, 14, 15, 16 and 17 before going on to Lesson 18.

## LESSON 13 — GENERAL POINTS

- 1. Use the correct tool, e.g. screwdrivers according to the size of the screw, correct punches, etc. If this rule is not observed, screws get burred, and can only be removed by an artificer.
- 2. Before attempting to withdraw screwed axis pins, make certain that the threads of the screw are fully unscrewed.
- 3. When replacing screwed axis pins, do not use force; the threads will engage without unnecessary pressure.  
If this rule is not observed, the threads (which are extremely fine) will become so burred that it will be impossible to replace the pin, e.g. cover lock screwed axis pin.
- 4. When raising the rear cover, do not throw it upwards but lift it. The hinges are liable to strain. Before lowering see that the lock is correctly in the gun.
- 5. Before closing down the front cover, see that the feed-block is correctly in position, and the front cover catch raised.
- 6. The firing pin should never be released unless the extractor is up against the top stop.
- 7. When removing parts secured by chains, do not tug on the chain; otherwise they get broken and the part eventually is lost, e.g. outer casing split pin, cork plug, screwed plugs, tripod pins.
- 8. With reasonable care defects and breakages in machine guns should be of extremely rare occurrence. They are simply due to neglect of ordinary precautions.
- 9. Direct hammer blows must never fall on any part of the gun. Wood must always be placed over the part to receive blows from a hammer or mallet.
- 10. In stripping examinations no time limit will be imposed, in order to avoid damage to the gun by careless handling.



## LESSON 14 — STRIPPING THE GUN

1. Lock. Unload, pull the crank handle on to the roller, raise the rear cover, see that the extractor drops, place the finger between the extractor and stop and lift the lock—at the same time allowing the crank handle to move slowly forward until the lock is released from the side plate. Give the lock a slight turn and lift it out.

2. Muzzle attachment. Withdraw the split pin, remove the blast deflector, turn the outer casing, and remove it. Unscrew and remove the muzzle cup.

3. Feedblock. Raise the front cover and lift out.

4. Fusee spring box. With the right hand at the rear and the left at the front, press the box forward until clear of the stud and remove. Disconnect the fusee chain and remove the box and the spring.

5. Fusee. Turn the fusee to the rear until the lugs on the stem are free to be withdrawn.

6. Recoiling portions. Raise the rear cover, unscrew the T fixing pin and lower the rear cross-piece; remove the right and left slides, and draw out the barrel and side plates. Disconnect the side plates, removing the left one first.

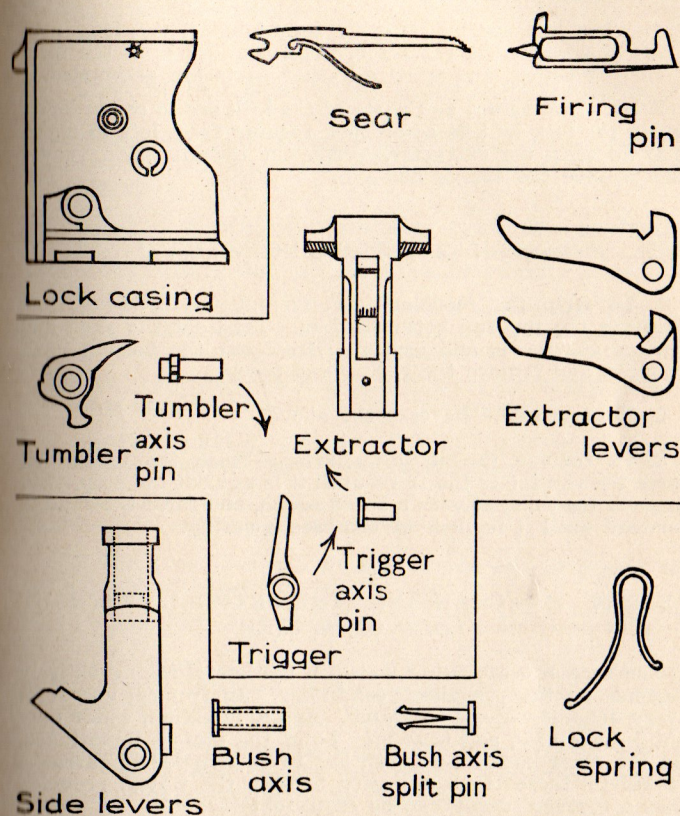
## To assemble the gun:—

1. Reverse all the foregoing operations.

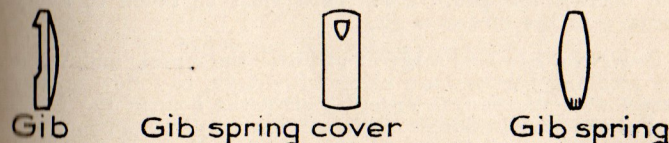
2. When assembling the barrel and side plates, ensure that the radial groove is uppermost and that no force is used. If the side plates are not home on the barrel trunnions and crankshaft, the barrel must be withdrawn and the side plates properly assembled; otherwise burrs on the crankshaft may occur.

## LESSON 15 — STRIPPING THE LOCK (PLATE 2)

1. To strip the lock.—See that the lock is cocked; force out the side lever split pin and axis bush; remove the side levers, extractor levers, and extractor. Push out the tumbler axis pin and remove. Release the lock spring, push out the trigger axis pin. Remove the trigger, lock spring, firing pin, and sear with spring.



## Component parts of extractor





2. **To assemble the lock.**—Reverse the above except:—

- i. Replace the tumbler before the trigger.
- ii. The lock spring must be forced home, the long arm towards the extractor, when the lock is in the fired position, and when all other parts are assembled.

NOTE.—The names and parts of the lock are in the order in which the lock will be assembled, reading from left to right.

3. **To strip the extractor.**—Push out the gib spring cover and remove the spring and gib.

#### LESSON 16 — STRIPPING—*continued*

1. **To strip the feedblock.**—Force out the split pin and separate the top and bottom levers. Take out the slide and remove the pawls and spring. Draw out the bottom pawl axis pin and remove the spring and pawls.

2. **To assemble.**—Reverse the above.

3. **To remove the sliding shutter.**—Press the catch and force the shutter to the front until it is against the stop, then press in the plunger with a No. 3 punch, and force the shutter forward until it is clear of the breech casing.

#### LESSON 17 — CHANGING THE BARREL WITHOUT LOSS OF WATER

The necessity of saving water in the barrel casing entirely depends on the prevailing conditions. In tropical countries every drop of water is of value. Again, in action, water may not be available, and time may be of the utmost importance. On the other hand, if the gun has to be stripped in barracks or billets, there is no necessity to save the water, provided that a further supply can be easily obtained.

Follow the normal sequence of stripping until the slides have been removed. Then remove the elevating joint pin and depress the gun. Great care must be taken to avoid damage to the direction dial.

Order No. 2 to hold a rag or pad over the muzzle and, when the recoiling portions are being withdrawn, to follow up the barrel with the pad, in order to close the hole in the front end of the barrel casing. Withdraw the recoiling portions.

In replacing the new barrel the above operations should be reversed.

The water may also be saved by allowing it to run from the barrel casing in a receptacle, when the barrel will be changed by the normal procedure.

#### LESSON 18 — STRIPPING COMPONENT PARTS

1. **Front cone, muzzle attachment.** Using the combination tool, unscrew the front cone from the outer casing muzzle attachment.

2. **Gland of the muzzle attachment.** Using the combination tool, unscrew the packing gland from the barrel casing. When assembling, ensure that the gland is screwed fully home.

3. **Front cover catch.** To remove the spring and plunger, force the plug inwards and give  $\frac{1}{4}$  turn by means of a screw-driver, when the plug will be forced out by the spring.

Before the plunger is removed, it must be turned so that the slides are free to pass the lugs in the catch.

4. **Tangent sight.** Unscrew the axis pin and remove. Remove the tangent sight piston and spring.

5. **Rear cover lock.** Unscrew the axis pin and remove. Remove the rear cover lock and spring.

6. **Trigger bar.** Remove the rear cover lock and trigger bar spring, and withdraw the trigger bar.

7. **Roller.** Remove the split fixing pin, collar, and roller.

GENERAL NOTE.—Training in stripping cannot be regarded as completed until men have reached a reasonable standard in stripping and assembling the gun and parts under—

- i. Blindfold conditions, where the instructor is able to guide and correct the errors committed, and so obviate damage to the equipment.
- ii. Under conditions of total darkness, where the man receives no assistance from the instructor.

#### SECTION 5 — SPARE PARTS

The importance of knowing what is and what is not carried spare should be impressed on all machine gunners. It is essential to know where to find any spare parts that may be required. All spare parts must be given their proper names. A list of deficiencies should be kept inside each box and the



necessity for checking spare parts whenever opportunity occurs must be emphasized. Breakages and losses must be reported immediately. Spare parts must be kept slightly oiled.

### Instructor's Notes

Stores:—

Gun, tripod, spare parts, case, and box.

The sequence of instructions will be:—

Having laid out the whole of the contents of the spare parts box, case, and wallet, teach the squad as follows:—

Hold up each article (in accordance with the official list of spare parts) and call out the correct name given to it. The use of the spare part being dealt with will be explained.

## LESSON 19 — DESCRIPTION

Describe the spare parts box, case, and wallet; teach the names and use of spare parts.

## LESSON 20 — PACKING

Teach the method of packing.

### CONTENTS OF WALLET

Cork for plug .. .. .	1
Cup, muzzle attachment .. .. .	1
Disc, muzzle attachment .. .. .	1
Fusee, with chain .. .. .	1
Gib .. .. .	1
Pins, trigger lock .. .. .	1
„ tumbler .. .. .	1
„ firing .. .. .	1
„ keep split, $\frac{1}{2} \times 2\frac{1}{2}$ in. (for Mk. IV tripod mtg.) ..	3
Pliers, side cutting, pairs .. .. .	1
Protector, muzzle .. .. .	1
Pull-through, double .. .. .	1
Punches, No. 3 .. .. .	1
„ No. 5 .. .. .	1
Reflector, mirror .. .. .	1

### CONTENTS OF WALLET—continued

Screwdrivers, small .. .. .	1
Sear, with spring .. .. .	1
Spring, gib .. .. .	1
„ lock .. .. .	2
Trigger .. .. .	1
Tumbler .. .. .	1
Washers, adjusting, No. 1, .003 in. .. .. .	3
„ „ No. 2, .005 in. .. .. .	3
Wire gauze (pieces) .. .. .	1

### CONTENTS OF SPARE PARTS CASE

Balance, spring .. .. .	1
Can, oil .. .. .	1
Flannelette for binding lutin pads, yards (a) .. ..	8
Lock breech .. .. .	1
Lutin, oz. (a) .. .. .	6
Plug, clearing .. .. .	1
Spring, fusee .. .. .	1
Tool, combination .. .. .	1
Wallet .. .. .	1

### CONTENTS OF SPARE PARTS BOX

Blocks, feed .. .. .	2
Boxes, small parts .. .. .	3
Bushes, axis, side levers .. .. .	1
Collars, roller .. .. .	1
Cork for plug .. .. .	1
Cups, muzzle attachment .. .. .	1
Discs, muzzle attachment .. .. .	4
Eyelets, long, oz. .. .. .	$\frac{1}{2}$
Fusee, with chain .. .. .	1
Gib .. .. .	1
Gland, packing .. .. .	1
Hammer .. .. .	1
Lever, extractor, left .. .. .	1
„ „ right .. .. .	1
Packing, asbestos (5-yard pieces) .. .. .	4

(a) Being replaced by Patch, first aid (see Sec. 7, subpara. 4), which will be carried in the lid of the spare parts box.



CONTENTS OF SPARE PARTS BOX—*continued*

Pins, trigger lock .. .. .	1
„ tumbler .. .. .	1
„ firing .. .. .	2
„ fixing crank handle .. .. .	1
„ split, collar, roller .. .. .	2
„ „ keeper, $\frac{1}{8} \times 2\frac{1}{2}$ in. (for Mk. IV tripod mtg.) ..	6
„ „ bush, axis, side lever .. .. .	1
„ „ check nut, long .. .. .	3
„ „ muzzle attachment .. .. .	1
„ T fixing rear cross-piece .. .. .	2
Plugs, belt .. .. .	1
„ cork, complete .. .. .	1
„ screwed .. .. .	1
„ front cover catch .. .. .	2
Plungers, front cover catch .. .. .	2
Roller .. .. .	1
Screwdrivers, large .. .. .	1
Sights, night, back and fore, each .. .. .	1
„ fore .. .. .	1
„ tangent .. .. .	1
Spanner, adjustable .. .. .	1
Springs, bottom pawl .. .. .	1
„ rear cover lock .. .. .	2
„ front cover catch .. .. .	2
„ gib .. .. .	1
„ lock .. .. .	4
„ safety catch with piston .. .. .	2
„ sear .. .. .	2
„ shutter catch .. .. .	2
„ tangent sight .. .. .	1
„ top pawls feed block .. .. .	2
„ trigger bar .. .. .	2
Strips, long .. .. .	25
„ short .. .. .	25
Tool, repairing belts .. .. .	1
Washers, elevating nut (tripod Mk. IV) .. .. .	6
Wire gauze (pieces) .. .. .	4

## SECTION 6—STOPPAGES AND IMMEDIATE ACTION

1. In order that the men may attain a high standard of training in dealing with stoppages, it is essential that the instructor should prepare the stoppages accurately in order that the correct immediate action may be applied by the No. 1.

Setting up stoppages should not be taught to the private soldier.

2. The following tables give the preparation, immediate action, etc., and will be taught to the various categories of machine gunners as under:—

- i. Columns 1, 3, and 4 .. All machine gunners.
- ii. Column 5 .. .. . When the machine gunner is proficient in immediate action.
- iii. Columns 1, 2, 3, 4, and 5 . All instructors.

*Instructor's Notes**Stores for Lessons 21-26.*

*Gun and tripod.*

*Condenser can and tube.*

*Ammunition box, belt, and dummy cartridges.*

*Bulged dummy.*

*Two dummy cartridges with prepared thick rims.*

*Front portion of a separated case and telescoped separation.*

*Spare parts case.*

*Covering for crank handle.*

1. The squad will be seated on the right side of the gun, so that the crank handle is visible, and the actions of the instructor more clearly seen.

2. A target must always be indicated at the beginning of the lesson.

3. While the stoppage is being set up, Nos. 1 and 2 will be at the "rest" position at the gun with their heads turned aside. The instructor will order "Position" followed by "Fire." He will then remove the covering from the crank handle, when the I.A. will be performed.

4. The stoppage should be set up as described.

5. Immediate action is not complete until the gun has been correctly relaid and fired.



6. The rear cover should neither be opened nor closed with the tangent sight raised.

7. If the lock cannot be drawn back, open the front cover, and force down the extractor.

8. The rear and front covers, when lowered, must always be fastened correctly.

9. A lock must never be changed with cartridges on the face of the extractor.

Should it become necessary to remove a cartridge from the face of the extractor, the lock will be removed from the guides in the side plates, care being taken to ensure that the extractor is kept down, the cartridge being moved off the extractor before the lock is changed (or replaced in the guides).

10. Should it be necessary to release the lock spring with the lock out of the gun, this should be done with the extractor held right up, so that the firing pin hole is opposite the firing pin.

11. When No. 2 takes an active part in I.A., his duties will be taught first.

12. As proficiency is attained, training should be carried out in darkness, or with Nos. 1 and 2 blindfolded.

13. Finally, men should be practised in carrying out I.A., without the assistance of a No. 2.

14. Lessons are divided into:—

21. First position stoppage.

22. Second position stoppage.

23. Third position stoppage.

24. Fourth position stoppage.

25. Special stoppages.

26. Causes of stoppages.

Note.—Proficiency in Lessons 21, 22 23, and 24 should be attained before Lesson 25 (special stoppages) is taught.

Lesson 26 should not be taught until proficiency is attained in Lessons 21 to 25 inclusive.

1. Stoppages in the automatic action of the gun may be classed under two main headings:—

i. Temporary, which are due to—

(a) Neglect of points before or during firing.

(b) Faulty ammunition.


(c) Ignorance on the part of the gun team.

(d) Failure of some part of the gun of which a spare is carried.

ii. Prolonged, which are due to failure of some part which cannot, as a rule, be put right by the team under fire, or without skilled assistance. These necessarily put the gun out of action for a more or less prolonged period.

2. On the knowledge and training of the team depends the rapidity with which temporary stoppages can be overcome.

# 1ST POSITION STOPPAGE

Position of crank handle	Method of preparation	Immediate action	Prevention of recurrence	Probable cause
 <p>Indication— The lock is unable to come back far enough to allow the extractor to drop.</p>	<p>Perform half the loading motions; pull the crank handle slowly back until the horns of the extractor have engaged with the steps of the cams; let go the crank handle and pull the belt to the left.</p> <p>Note.—In all cases except where the stoppage is caused by a weak charge the preparation must be repeated.</p> <p>Note 2.—For range purposes— To set up a stoppage caused by a weak or broken gib spring, perform half the loading motions, open the rear cover, withdraw and lift up the lock. Slide the cartridge on the face of the extractor half way down the lower projection of the gib, replace the lock, and pull the belt to the left.</p>	<p>i. Pull the crank handle on to the roller, pull the belt to the left, and let go the crank handle.</p> <p>ii. If failure recurs, repeat (i) and lighten the fusee spring by three "clicks."</p> <p>iii. If, after carrying out (i) the crank handle stops in the same position when going forward, pull the crank handle on to the roller, open the rear cover, clear the face of the extractor, change the lock and reload.</p>	<p>ii. Attend to points before and during firing.</p>	<p>The extractor has not dropped. This may be due to:— i. Weak charge. ii. (a) Too heavy fusee spring. (b) Want of oil in working parts. (c) Grit in working parts. (d) Excessive packing. (e) Worn barrel. (f) Tight pockets. (g) Friction due to frozen oil or water. iii. Weak or broken gib spring.</p>




## 2ND POSITION STOPPAGE

Before the second position stoppage is taught, the use of the clearing plug will be taught as follows:—

**The T-shaped clearing plug.**—To remove a separated case. Insert the tapered portion of the clearing plug with the centre pin pushed back, into the chamber. Push the pin well home by allowing the lock to go forward. Then, keeping a firm pressure on the crank handle, give the clearing plug handle a rocking motion, pull back the crank handle: knock back the handle of the plug, and withdraw the tapered portion of the plug from the chamber. The front portion of the separated case will be found adhering to it. Knock the centre pin back and remove the separated case.

**The cartridge-shaped clearing plug.**—Place the clearing plug between the upper and lower projections of the gib, load, and continue firing.

The clearing plug will be ejected in the normal way: the No. 2 will recover it and remove the separated case.

Position of crank handle	Method of preparation	Immediate action	Prevention of recurrence	Probable cause
<p>ii</p> 	<p>i. (a) Insert a bulged dummy cartridge as the first cartridge in the belt, and load.</p> <p>For range purposes—place a bulged dummy cartridge in the belt.</p> <p>(b) Perform half the loading motions. Open the rear cover, withdraw, and lift up the lock. Place the front portion of a separated case securely over the bullet of the cartridge on the extractor. Replace the lock, pull close the rear cover, pull the belt, and let the crank handle go slowly forward.</p> <p>Note—Another method is to use a dummy with the front portion of a separated case soldered on it.</p>	<p>i. Force the crank handle to the rear and call out "Clearing plug," open the rear cover, lift up the lock, and examine the cartridge on the face of extractor. If a damaged cartridge or an undamaged cartridge with the front portion of a separated case adhering to it is found, call out, "Don't want it," clear the face of the extractor and reload.</p>	<p>i. (b) and (ii). If a series of separated cases occurs, change the lock. If, after changing the lock, they still occur, remove the lock and place a No. 1 and No. 2 washer in front of the adjusting nut. At the first opportunity the washers will be placed behind the adjusting nut.</p> <p>Note.—This will be reported to the armourer.</p>	<p>i. (a) Damaged cartridge.</p> <p>(b) Separated case with front portion withdrawn telescoped on undamaged cartridge.</p>

Indication—The lock is unable to go fully home after recoil.

## 2ND POSITION STOPPAGE—continued


Position of crank handle	Method of preparation	Immediate action	Prevention of recurrence	Probable cause
	<p>ii. Perform half the loading motions, raise the rear cover and lift out the lock. Place the front portion of a separated case lightly over the bullet of the round on the extractor and allow the lock to go slowly forward, ensuring that the separation will remain in the chamber. Close the rear cover and pull the belt to the left.</p>	<p>ii. If an undamaged cartridge, with no front portion of separated case adhering to it, is found on the face of the extractor, replace the lock, keeping the crank handle on the roller. Use the clearing plug and reload.</p>		<p>ii. Separated case, front portion remaining in chamber.</p>



### 3RD POSITION STOPPAGE

Before teaching the stage in the third position stoppage when the extractor requires forcing down, explain the correct method of using the clearing plugs:—

- (a) **The T-Shaped Clearing Plug.**—Grip the clearing plug with the left hand at the top of the handle, the tapered portion resting on the top of the clenched hand. Place the end of the handle on the top of the extractor, and with the right hand give the clearing plug a sharp blow downwards.
- (b) **The Cartridge-Shaped Clearing Plug** will be gripped in the left hand, with the rounded end resting on the top of the extractor. A sharp blow with the right hand on the clenched left hand should suffice to force the extractor down.

Position of crank handle	Method of preparation	Immediate action	Prevention of recurrence	Probable cause
<p>III</p> 	<p>i. Perform half the loading motions, then pull the crank handle on to the roller, and raise the cover, pull the belt just sufficient to move a cartridge half-way into the face of the feed block. Allow of the crank handle to go slowly forward so that it will remain in the third position, and lower the rear cover.</p> <p>ii. Proceed to load, but the crank handle must be eased forward the second time in order that it may remain in the third position.</p> <p>Note.—In the event of a stoppage due to friction, the preparation must be repeated.</p>	<p>i. Slightly raise the crank handle, pull the belt to the left, let go the crank handle, and then strike it down on the check lever.</p> <p>ii. If the stoppage recurs, repeat the immediate action, unload, oil the lock and reload.</p>	<p>i. Examine the cartridges in the belt.</p>	<p>i. A cartridge is fed up slightly crosswise.</p>
<p>Indication—The extractor is unable to rise to its highest position. If the feed block slide is jammed, there is a fault in feed.</p>			<p>ii. Attend to points during firing.</p>	<p>ii. Friction in lock, etc.</p>

### 3RD POSITION STOPPAGE—continued

Position of crank handle	Method of preparation	Immediate action	Prevention of recurrence	Probable cause
	<p>iii. Pull out the fourth cartridge in the belt about half an inch. Perform half the loading motions; pull the crank handle slowly back until the horns of the extractor have engaged with the steps on the cams. Draw the recoiling portions to the rear by forcing the knob of the crank handle forward, and the tail to the rear, at the same time pulling the belt to the left. Bring the crank handle on to the roller and ease forward. For range purposes.—Fill a belt badly, or bend a long brass strip, or place the box at an angle to the feed block.</p>	<p>iii. If (i) fails, examine the feed block slide. If jammed, No. 1 calls out "Feed block," pulls the crank handle on to the roller (in order to do this it may sometimes be necessary for No. 2 to force down the horns of the extractor), raises the rear cover and hangs the lock. No. 1 then draws back the recoiling portions while No. 2 depresses the pawls and withdraws the belt. No. 1 then allows the recoiling portions to go forward, thus allowing the feed block slide to go over to the left. No. 2 then straightens the rounds in the belt. No. 1 will then lower the rear cover, pull the crank handle on to the roller, pull the belt to the left, and let go the crank handle.</p>	<p>iii. Attend before pointing during firing. Note.—Badly filled belts are the chief cause of stoppages in the third position.</p>	<p>iii. (a) Bent or damaged long brass strip. (b) Badly filled belt. (c) Worn or loose belt pockets. (d) Belt box not in line with the feed block.</p>




### 3RD POSITION STOPPAGE—continued

42

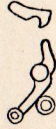


Position of crank handle	Method of preparation	Immediate action	Prevention of recurrence	Probable cause
	<p>iv. Place a dummy with a thick rim as second cartridge in the belt. Proceed to load, easing the crank handle forward the second time.</p> <p>For range purposes.—Damage the rim of a dummy cartridge and place it in the belt.</p> <p>Notes.—1. A special dummy can be used, having a thin washer soldered on to the base.</p> <p>2. This stoppage should seldom be practised on the range, since the thickened rim may damage the grooves of the extractor.</p>	<p>iv. If the slide is free, No. 1 calls out "Extractor" and opens the front cover. No. 2 forces down the horns of the extractor. No. 1 clears the face of the extractor. No. 2 depresses the pawls, withdraws the belt and removes the first cartridge in the belt, and then No. 1 closes and locks the front cover and reloads.</p>		<p>iv. Thick rimmed cartridge.</p>

### 4TH POSITION STOPPAGE

43

Position of crank handle	Method of preparation	Immediate action	Prevention of recurrence	Probable cause
<p>IV</p>  <p>Indication—There has been no explosion, or if any, there has been little or no recoil, the lock remaining in its forward position.</p>	<p>i. Load. Press the thumb-piece. For range purposes—insert a dummy in the belt.</p> <p>ii. Load and press the thumbpiece, and on No. 1 applying the immediate action the instructor says "Gun will not fire."</p> <p>For range purposes.—insert two dummies in the belt.</p> <p>iii. Press the thumbpiece. Insert the belt in the feed-block until the first cartridge is in line with the finger-piece of the bottom pawls.</p> <p>For range purposes—leave a space in the belt.</p>	<p>i. Pull the crank handle on to the roller, pull the belt to the left and let go the crank handle.</p> <p>ii. If (i) fails, pull the crank handle on to roller twice, change the lock and reload.</p> <p>iii. If, when performing (i), No. 1 notices that more belt than usual comes through to the left, he performs the second half of the loading motions.</p>	<p>iii. Inspect belts.</p>	<p>i. Misfire.</p> <p>ii. (a) Broken or damaged firing pin. (b) Broken lock spring. iii. Empty pocket in the belt.</p>



Position of crank handle	Method of preparation	Immediate action	Prevention of recurrence	Probable cause
	Perform half the loading motions. Remove the fusee spring box and spring. Pull the crank handle on to the roller. Pull the belt to the left. Replace the fusee spring box with the spring detached from the fusee.	Remove the fusee spring box. Pull the belt to the left and return the crank handle to the check lever. Replace the broken fusee or spring. If the spring is broken, adjust to the correct weight.		Broken fusee or fusee spring.
Indication — Crank handle resting on roller.	Place two thick-rimmed dummy cartridges as the second and third rounds in the belt. Proceed to load, easing the crank handle forward the second time. When resistance is met, give the crank handle a light tap downwards.	If after applying the immediate action for a thick rimmed cartridge the stoppage recurs on reloading, repeat the immediate action and change the lock.		(a) Damaged cartridge grooves. (b) Broken gib spring. (c) Broken gib.
	(a) (b) (c) Unload and release the lock spring. Pull the belt until the first round is in the front of the bottom pawls. The man must now apply the I.A. as for broken lock spring. When the man has completed this I.A., he should be told that the gun only fired two rounds and stopped again in the same position.	(a) (b) (c) Apply the immediate action for the fourth position stoppage. After the lock has been changed the gun fires two rounds and then stops in the same position. The feed block will be changed.		<b>Broken</b> (a) Upper lever. (b) Lower lever. (c) Top pawls or spring.
				

## SPECIAL STOPPAGES—continued

Position of crank handle	Method of preparation	Immediate action	Prevention of recurrence	Probable cause
	(This should lead him to inspect the feed block where the breakage will be found). (d) Set up as for empty pocket in the belt. When the man has completed the correct immediate action for the above, he will be told that the gun fired only two rounds and stopped again in the same position.	(d) Apply immediate action as for empty pocket in the belt. The gun will fire two rounds and stop in the same position. The feed block will then be changed.		(d) Bottom pawls or springs.
	1. Give the order "Load." As soon as the crank handle touches the check lever for the second time, say "Gun firing." 2. Order "Load" and "Fire" followed by "Stop." Directly No. 1 releases pressure from the thumbpiece, say "Gun still firing."	1. No. 1 will remove a round from the belt. 2. When the gun stops firing, he will pull the crank handle on to the roller. 3. No. 2 will remove the belt. 4. No. 1 will release the crank handle. The lock can then be changed with safety.		(a) Broken or worn nose of trigger or bent of tumbler. (b) Broken short arm of lock spring above trigger axis pin.

Note.—Should a stoppage occur in any position when the gun cannot be stopped by releasing the thumbpiece, the I.A. will always be: crank the handle on to the roller and remove the belt. In the case of a second position stoppage, extreme care must be taken that the extractor is kept down while the round is being removed.



## SECTION 7 — REPAIRS

## LESSON 27 — REPAIRS

*Instructor's Notes**Stores:—*

*Gun, tripod, spare parts case and box, parts of an old belt, sufficient flannelette and lutein.*

*The lateral adjustment of the foresight will not be taught to private soldiers.*

*If lutein is not available, any suitable substance, e.g. plasticine or putty, may be used for instructional purposes.*

1. Fitting spare discs for the muzzle attachment. Unscrew the front cone, cut the edge of the disc, driving sufficient metal up to provide a hold for the pliers. Remove the disc and replace it with a new one.

In replacing it may be necessary to tap the disc on to the front cone.

2. Fitting auxiliary, packing gland. In the event of the packing gland being damaged by bullets, etc., it can be replaced by the auxiliary packing gland as follows:—

Remove the outer casing muzzle attachment, muzzle cup and damaged packing gland, screw in the auxiliary packing gland, using the combination tool, and lighten the fusee spring by about 3 lb.

3. Lateral adjustment of the foresight. If the foresight has become damaged or displaced, re-adjustment will be necessary. This will only be carried out by an experienced N.C.O.

It will be carried out on the 30-yards range.

Target.—Any target with a thick vertical line as an aiming mark with a pencil line  $\frac{1}{2}$  in. to the right of the middle of the thick line, the pencil line being invisible to the firer.

Settling bursts will first be fired.

Then a group of ten rounds will be fired by inserting a punch between the firing lever and the safety catch.

If the gun is sighted correctly, the mean point of impact will be on the thin pencil line, i.e.  $\frac{1}{2}$  in. to the right of the point aimed at.

If there is any lateral error, the foresight will be tapped in the same direction as the error, using a No. 3 punch and hammer.

Another burst of ten rounds will be fired after each adjustment until the sighting is correct. Adjustments are very fine, and great care must be exercised in tapping the foresight.

When the foresight is very tight, the bracket should be supported to prevent it from jarring loose. It is important that the socket of the tripod should be perfectly upright. After each group is fired, the aim must be carefully checked to see that the tripod has not moved.

## 4. Perforation of the barrel casing

(a) In the event of the barrel casing being pierced by bullets, etc., the gun being thus out of action, repairs will be carried out locally in accordance with the following methods, to enable the gun again to take its place in the firing line with the least possible delay.

i. Temporary "first aid" repairs to be carried out by the gun team.

ii. Semi-permanent repair to be carried out by an armourer when opportunity occurs.

(b) To effect (i) take one of the rubber pads from the spare parts box, place over the hole, position the metal plate on top and retain the whole by two of the flexible metal clips around the barrel casing.

The methods described will not remedy the defect when there is a hole in the end cup into which the tubular portion of the casing is screwed.

(c) The following stores are supplied to enable the repair at (i) to be carried out:—

Patches, first aid.

Pads .. .. 2	} to be carried in a tin box in the spare parts box.
Plates .. .. 2	
Clips .. .. 4	

5. Use of the tool for repairing belts. Mark (I) with strips.

Remove the damaged strips and eyelets. If a long strip requires fitting, first join the two faces of the strip as follows:

Place the eyelet in the hole of the dished end, insert the punch of the tool into the unopened end of the eyelet (the open end should rest on the die) and gently press the handles together, then put the punch in the other end of the eyelet, and press the handles. Keep the strip horizontal, move the handles of the tool backwards and forwards in a circular direction, with the punch of the tool as the centre, so as to shape the head of the eyelet.

Put the strips into position on the belt, insert the eyelet, and repeat the above operation.

Short strips are fitted in a similar manner, except that they do not require to be joined at one end before being placed on the belt.



Care must be taken to press the eyelets as far through the strips as possible before using the tool.

#### 6. To repair a torn belt.

If badly torn, cut out the torn portion, sew or rivet together the cut ends, and cover with the brass strips. The cutting of the belt should be done in such a manner as to ensure that the repair to the top portion of the webbing does not coincide with the repair to the bottom portion.

## SECTION 8—BLANK FIRING ATTACHMENT

### LESSON 28—BLANK FIRING ATTACHMENT

#### *Instructor's Notes*

#### *Stores:—*

*Barrel, Mark II "D.P.B." (drill purposes, blank).*

*Cone, front, muzzle attachment, blank.*

*Cup, muzzle attachment, blank.*

*Nut, adjusting, muzzle attachment, blank.*

*Screw, adjusting, muzzle attachment, blank.*

*Spanner, muzzle attachment, blank.*

1. The barrel is specially choked at the breech and is marked "D.P.B." on the trunnion block.

The adjusting screw is screwed into the front cone from the rear, so that its large end may engage in the muzzle cup.

The front cone with adjusting screw assembles into the outer casing of the muzzle attachment in place of the existing front cone.

The adjusting nut screws on to the projecting end of the adjusting screw and locks against the face of the front cone.

The spanner is suitably arranged for the muzzle cup, adjusting screw and nut.

2. Adjustment of the gun when assembled with the special parts. The weight of the recoiling parts of the gun should not exceed 2 lb.

The weight of fusee spring should be about  $4\frac{1}{2}$  lb.

The adjusting screw of the muzzle attachment should first be screwed inwards to the muzzle cup until it just begins to force the recoiling portions backwards; it should then be unscrewed  $1\frac{1}{2}$  turns and secured in position by the nut. The screw may require further adjustment in order to obtain correct functioning, but in no case should the screw be less

than 1 turn back from the muzzle cup. Adjustment should be made in quarter turns.

#### NOTES.

1. *Service guns only will be used for firing.*

2. *A belt, preferably part-worn as regards size of pockets, should be employed. The blank ammunition should be inserted crimped end flush with the front edge of the belt in groups of 10 rounds each. This number is sufficient for the purposes of locating machine gun fire, and also ensures a longer life of choke in the barrel.*

3. *When firing becomes noticeably irregular, the barrel should be set aside for examination by an armourer.*

4. *The barrel casing will be filled with water as for ball ammunition.*

5. *When the gun is fitted with the blank firing attachment, it cannot be placed in its chest unless the outer casing of the muzzle attachment with its fittings is first removed.*

6. *On completion of blank firing the guns will immediately be restored to their normal condition for firing ball ammunition.*

7. *The gun will be cleaned in the normal way (i.e. as if the ball ammunition had been fired), except that no attempt will be made to clean the inside of the barrel in front of the choke.*

## SECTION 9—INSTRUMENTS AND AIMING

### GENERAL.

1. All ranks must be proficient in the use of the following:

Aiming post.

Zero post.

Direction dial.

Elevating wheel.

Dial sight (or clinometers and bar foresight, *see* Appendix I).

Aiming lamp.

2. Officers and N.C.Os. must be proficient in the use of the slide rule. The former and full rank N.C.Os. will also be trained to use:—

Director. No. 4 or No. 9.

Plotter.

Resector Protractor.



3. In addition to the above, all officers and N.C.Os. should be able to determine whether a dial sight is in adjustment. Similarly, those officers and N.C.Os. who are trained in the use of the director should be able to test the instruments for accuracy.

4. For the standard to be reached, see T.O.E.D.

## LESSON 29 — TANGENT SIGHT AND FIXED SIGHT

### *Instructor's Notes*

*Stores:—*

*Gun, tripod, ammunition box, aiming post, landscape target.*

#### 1. Setting the sights.

Explain and demonstrate:—

- i. The use of sights to obtain direction and elevation.
- ii. The method of adjusting the sights. Fifty yards will be taught as the smallest adjustment.
- iii. The correct line on the graduated plate for any particular range is the one under the figures indicating that range.
- iv. The fixed sight will be used up to 550 yards inclusive (except when firing range practices).

The men should be required to make several adjustments.

#### 2. Rules of aiming.

Explain:—

- i. Sights must be upright. This is ensured by correct mounting of the tripod.
- ii. The eye should be as close to the aperture as possible.
- iii. The firer must look through and not at the aperture.

Demonstrate the common faults of aiming (see Pamphlet No. 3, Lesson 6).

Explain that, in aiming at a bullseye for instructional purposes, or at the aiming post or lamp, the aim must be taken at the lowest central portions, as the foresight will not show up clearly if laid on the centre.

#### 3. Methods and sequence of instruction in laying an aim.

- i. Lay a correct aim at the aiming post *without* "holding." While laying, the chin must be supported on the hand. An ammunition box may be placed across the knees and the elbows rested on the box, or the

PLATE 3.

(To face page 50.)

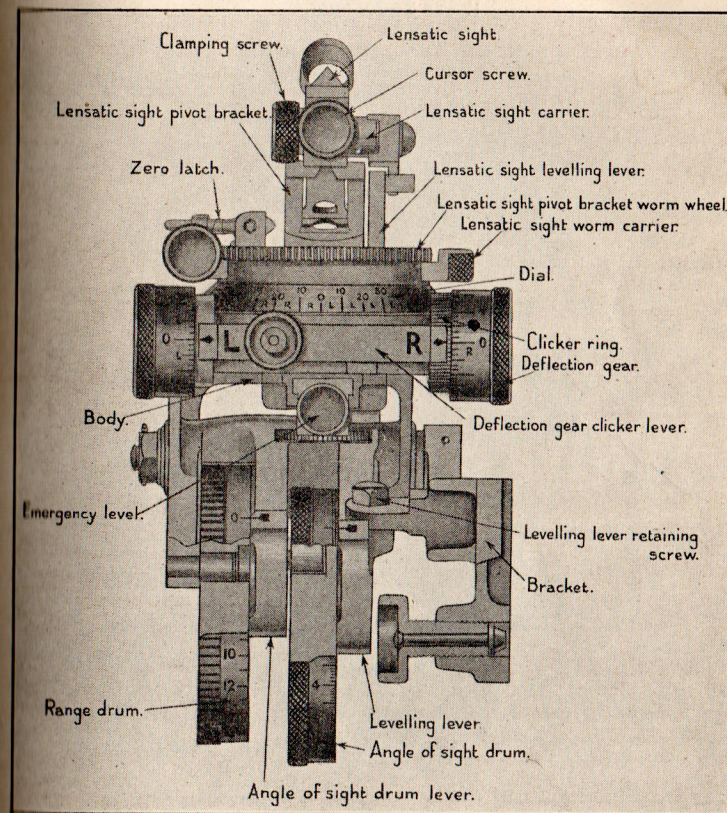
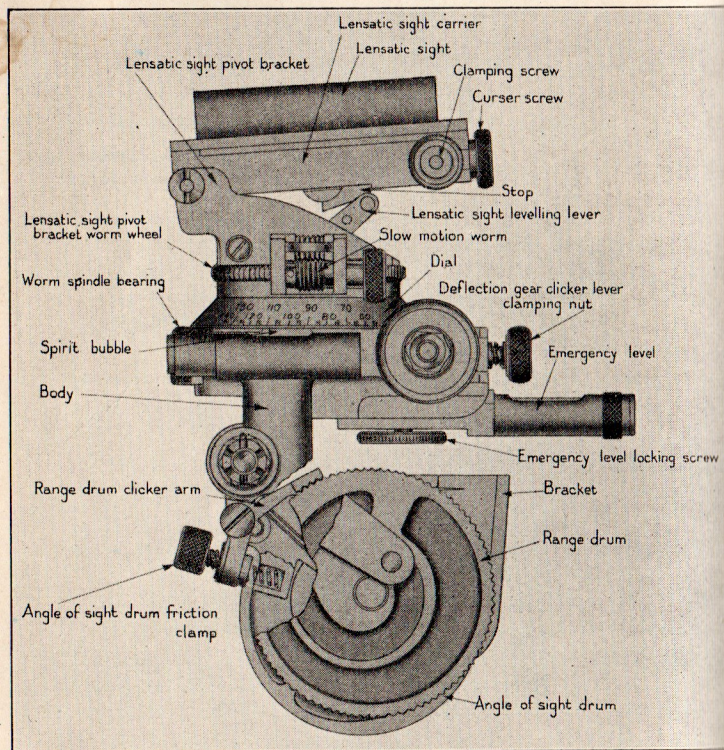




PLATE 3—continued.



box may be placed on the ground resting on end, and the arms rested on top.

Explain that direction is obtained by tapping the traversing handles, and elevation by turning the wheel.

- ii. Every man should view the aim, and in turn lay the gun, without holding.

Should any faults be detected, explain their effects, and ensure that such faults are remedied.

If a man's aim is incorrect, he must be convinced that it is so.

- iii. The men will be taught to lay an aim with "holding." The tripod must be in good condition, otherwise there will be considerable difference in aim with and without holding. There should be little difference.

- iv. Show how to lay an aim at points on a landscape target, and finally on natural objects.

- v. Show how to note a point of aim to the right or to the left of the original mark.

Tap the gun off and ask the man to describe where the gun is laid.

Explain that this point is an auxiliary aiming mark.

- vi. Demonstrate how to select and note a point of aim immediately above or below the target by moving the tangent slide up or down.

Explain that this point is a gun aiming mark.

## LESSON 30 — DIAL SIGHT (PLATE 3)

### *Instructor's Note*

*Stores:—*

*Gun, tripod, dial sight.*

Explain and demonstrate the following:—

Collimator.

Lateral and vertical adjustment of collimator.

Dial and deflection drums.

Indicator bar.

Spare clinometer level.

Elevation drums.

Tapered bracket.

**Description.**—The sight consists of a tapered bracket with fixing screw, for attaching to the gun bracket.



Two elevation drums with quick release and pointers:—

- (a) The range drum, graduated in 100s of yards up to 4,500 yards. Up to 400 yards one click represents 100 yards. Over 400 yards one click represents 50 yards.
- (b) The angle of sight drum, graduated in 5s of minutes up to 10 degrees of elevation and depression.

A dial, marked in 10s of degrees from 0 to 180 degrees, left and right, with a quick release, also right and left deflection drums, marked in 10s of minutes.

An adjustable indicator bar, with arrows at each end for use with the deflection drums. This drum can be made to click or friction as desired by means of the milled head screw. Under this screw is housed a spare clinometer level.

On the left of the dial is a clinometer level. Mounted on top of the dial is a collimator with pyramid. This is adjustable vertically, by means of a fine adjustment screw. The whole of this portion is zeroed by means of a spring catch and horns, which can be freed by means of a quick release on the right. This release allows the collimator to rotate. Between the horns is a fine adjustment worm which engages in the teeth of the bottom plate of the collimator, and is operated by a fine adjustment screw.

### LESSON 30A — BAR FORESIGHT

#### *Instructor's Notes*

*Stores:—*

*Gun, tripod, bar foresight.*

Explain and demonstrate the following:—

1. The graduations on the bar, the pointers, and the markings R. and L.

The graduations on the upper surface of the bracket.

The sliding sight and clamp screw.

The clamping screw on the bracket.

#### 2. To affix the bar foresight.

Gun mounted, No. 2 kneeling on the right of the gun with bar foresight in pouch, slung over left shoulder.

No. 2 will remove the bar foresight from the pouch, seeing that it is set at zero. He will place it over the foresight protecting wings of the gun, and, being careful that the spring stud engages on the opening on the right wing, will tighten up the clamp screw on the bracket.

#### 3. To lay off an angle of direction with the bar foresight.

Gun mounted, with bar foresight affixed, and laid on an aiming mark. No. 2 at the gun.

No. 2 will adjust the bar foresight in accordance with the deflections given.

It should be noted that the sight is moved in the opposite direction to that ordered, i.e. if *right* is ordered the sliding sight is moved to the *left*.

Adjustments will be made to the nearest 10 minutes. When the bar foresight is replaced in its pouch, it will be set at zero.

### LESSON 31 — AIMING WITH THE DIAL SIGHT

#### *Instructor's Notes*

*Stores:—*

*As for Lesson 30, with addition of aiming post, aiming lamp, two zero posts and one direction peg.*

*A dark room or shed which can be illuminated quickly is an advantage, as faults in aiming can be shown by turning on the lights.*

#### 1. Explain and demonstrate:—

- i. Sights must be upright.
- ii. The eye should be about three inches from the collimator.
- iii. By moving the head about, the top of the pyramid will be made to appear above the tube. This will allow the tip of the pyramid to be laid on the lowest central portion of the aiming mark.



## iv. Night aiming.

To assist the man, it may be necessary for the N.C.O. at the gun to shine his torch at an angle into the front of the collimator.

## v. Correct aim with dial sight.

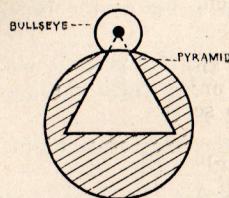


FIG. 1

## 2. The squad will view an aim laid by the instructor on:—

- i. Aiming post.
- ii. Aiming lamp.
- iii. Two zero posts.
- iv. Zero post, direction peg and lamp.

## 3. Practice squad.

Constant practice in actual darkness is essential.

## LESSON 31A — THE CLINOMETER

*Instructor's Notes**Stores:—*

*Gun, tripod, clinometer.*

## Explain and demonstrate:—

1. The graduations on the cradle and micrometer collar.  
Method of adjustment by milled head and quick release.  
The arrow on the base.

2. To place elevation or depression on the gun by means of the clinometer.

Gun mounted approximately level. No. 2 kneeling on the right side of the gun, clinometer in case, set at zero, slung over the left shoulder.

No. 2 removes the clinometer from its case and sets it at the angle ordered. He places it, *with the arrow to the front*, on the side plates of the breech casing of the gun. It should be placed so as not to foul either the trigger bar lever, or the tail of the trigger. By moving the hand wheel, No. 2 centralizes the spirit bubble.

The clinometer will be set at zero when it is no longer required. At other times it will be left at the setting ordered. Elevations will be given to the nearest five minutes.

## 3. To ascertain the quadrant elevation on the gun.

Gun mounted and laid at any angle of elevation or depression. No. 2 kneeling on the right side, with clinometer set at zero.

No. 2 places the clinometer on the side plates of the breech casing, *arrow pointing to the front*. He turns the milled head until the bubble is central, removes the clinometer and takes the reading.

## LESSON 32 — DIRECTION

(a) *Laying the gun for direction.**Instructor's Notes**Stores:—*

*Gun, tripod, dial sight, aiming post and director.*

Gun mounted, dial sight attached with all scales at zero.

A direction will be mounted in a suitable position and an aiming post put out.

## 1. Explain and demonstrate:—

On the order "Zero lines," "Right (or left) . . . degrees . . . minutes," No. 1 will set the dial and deflection drums as ordered. He will tap the gun and elevate or depress the collimator until it is laid on the centre of the director. The direction dial and deflection drums will be re-set at zero and the collimator adjusted until a correct aim is obtained on the aiming post.



## 2. Practise squad.

*(b) Maintenance of direction.*

1. In checking for direction during firing or on the command "Stop," the gun will be tapped until direction is obtained on the aiming post.

## 2. Practise squad.

## LESSON 33 — ELEVATION

*(a) Placing elevation or depression on the gun by means of the dial sight.**Instructor's Note*

*Stores:—*

*As for Lesson 32.*

## 1. Explain and demonstrate:—

Gun mounted and dial sight attached with all scales at zero, aiming post put out, and collimator adjusted to it. On a range and angle of sight being ordered, No. 1 places them on the elevation drums and levels the bubble by means of the elevating wheel. When levelling the bubble, No. 1 will retain his holding with his left hand. The collimator will then be adjusted to a correct aim on the aiming post. Orders in range to be given to the nearest 50 yards. Orders in elevation to be given to the nearest 5 minutes.

NOTE.—When a quadrant angle is ordered, the range drum will remain at zero.

## 2. Practise squad.

*(b) Maintenance of elevation.*

1. In checking for elevation during firing or on the command "STOP" the firer will check, and if necessary correct:—

*(a) Elevation drums.*

*(b) Bubble.*

*(c) Alignment of the collimator.*

## 2. Practise squad.

## LESSON 34 — RECORDING ON THE DIAL SIGHT THE QUADRANT ELEVATION OR QUADRANT ANGLE ON THE GUN

*Instructor's Note*

*Stores:—*

*Gun, tripod, dial sight.*

## 1. Explain and demonstrate:—

Gun mounted and laid on a target with any range on the tangent sight.

i. No. 1 attaches the dial sight, places the same range on the range drum, levels the bubble by means of the angle of sight drum and then clamps up.

The two drums will now record the quadrant elevation.

ii. No. 1 attaches the dial sight, sets the range drum at zero and levels the bubble by means of the angle of sight drum.

The resultant angle on the drum will be the quadrant angle.

## 2. Practise squad.

## LESSON 35 — DIRECTION DIAL, MK. II

*Instructor's Note*

*Stores:—*

*Gun and tripod.*

## 1. Explain and demonstrate:—

Graduations.

Markings "R" and "L."

Pointer.

Clamping screw.

## i. Description.

The direction dial is graduated from 0 to 180 degrees RIGHT and LEFT. 0 is marked by a screw. The scale can be rotated round the socket, and can be fixed in any position by a clamping screw. A pointer is fitted to the right hand side of the crosshead for use in connection with the dial.

## ii. To set the dial at zero.

No. 2 loosens the clamping screw, rotates the dial until 0 is opposite the pointer, and then screws up the clamping screw.



- iii. To lay off an angle of direction by the dial.

Gun mounted and direction dial set at zero, No. 2 at the gun. No. 2 loosens the traversing clamp and swings the gun so that the pointer moves towards "R" or "L" as ordered. He adjusts the pointer to the number of degrees or minutes ordered, and tightens up the traversing clamp.

Switches should be given out in multiples of 10 minutes, and adjustments made to within 10 minutes.

2. Practise squad.

### LESSON 36 — ELEVATING WHEEL

#### *Instructor's Note*

*Stores:—*

*Gun and tripod.*

1. Explain:—

The elevating wheel is marked by wide notches for degrees, thin notches for ten minutes, and dots for five minutes.

A pointer is attached to the elevating gear for use with the wheel.

The graduations on the wheel will be explained to the man.

2. Show how to elevate or depress the gun.

Gun mounted and laid on an aiming mark No. 1 at the gun. No. 1 will elevate or depress the gun the necessary amount by means of the wheel. On completion No. 1 will re-align his sights on the aiming mark by means of the tangent sight slide.

3. Practise squad.

### LESSON 37 — AIMING POST M.G., MARK III, AND ZERO POST M.G., MARK I

#### *Instructor's Note*

*Stores:—*

*Gun, tripod, dial sight, aiming post and zero posts.*

1. AIMING POST.—

- i. Explain and demonstrate:—

Folding arm.

Lamp bracket.

Securing extension.

- ii. Describe how the aiming post consists of a triangular base, with three spikes for securing the post into the ground. The stand has an adjustable arm with an aiming mark and lamp bracket, and an extension to act as a support. The following will be explained to the man:—

- iii. A gun will be mounted, dial sight attached, and No. 3 will be instructed to put out the post about 15 yards to the left front of the gun. The aiming post should be vertical or lying on its side, with the flat side of the base and the securing extension on the ground.

- iv. Practise squad.

### 2. Zero post, M.G., Mark I.—

Explain:—

The post is 3 feet long; it has a ring 4 inches in diameter at the upper end, and the lower end is pointed.

### LESSON 37 A — AIMING POST AND ZERO POST, MARK I

#### *Instructor's Notes*

*Stores:—*

*Gun, tripod, bar foresight, aiming post, zero post.*

### 1. Aiming post, Mark I.

Pamphlet 7 (Lesson 37).

- i. Explain and demonstrate:—

The telescopic portion.

The collar on the inner rod.

The bracket.

That when used in conjunction with the clinometer and bar foresight, an aiming post is required for each gun.

- ii. To plant the aiming post when used with bar foresight:—

The gun will be mounted and laid with any quadrant angle. The bar foresight will be affixed. No. 1 at the gun, No. 3 a few yards in rear with aiming post.

No. 1, without moving the gun, runs the tangent sight up to 2,500 yards (this range applies either for a Mark VII or a streamline tangent sight). No. 3 moves up to the gun and looks over the sights to ascertain the approximate position for the aiming post. He will then plant the post not less than 5 yards in front. No. 1 will direct No. 3 by signal to move the post until the line of sight is at 6 o'clock on



the aiming mark. (Mark I Aiming Post)—No. 3 should place the aiming post, or plant it vertically. If this is not possible, the foot of the post should be driven firmly into the ground sufficiently far to one side to admit of full use being made of the telescopic portion.

(Mark III Aiming Post)—No. 3 should lay post on its side with the flat side of the base and its securing extension on the ground. If this is not possible, he will plant it vertically, making final adjustment with the folding arm.

## 2. Zero post.

To plant Zero Post:—

Gun mounted and laid with any quadrant angle, bar foresight affixed. No. 1 at the gun, No. 3 a few yards in rear with the Zero Post. The instructor may act as the No. 1. Nos. 1 and 3 act in the same manner as when planting the aiming post.

The zero post will be planted so that the line of sight is on the point where the ring joins the stem. If it cannot be planted upright it will be planted leaning sideways.

## LESSON 38 — LAMP, AIMING, M.G., MARK III.

### *Instructor's Note*

*Stores:—*

*Aiming lamp and aiming post.*

1. Explain and demonstrate:—  
Aiming lamp.

The lamp is contained in a box divided into three partitions, one containing the lamp, another two batteries, and the third a two-way switch with wire lead to the external ring; line and reel, securing chain and spare bulb.

On the base of the box is a securing hook.

i. Attaching the lamp to the aiming post.

The box will be opened, the lamp removed and the cable passed through the slot in the side of the box. The lamp will be secured to the extension above the aiming mark on the aiming post, with the bracket uppermost, by tightening the wing nut.

NOTE.—The box must be closed, and placed close to the aiming post with the ring facing No. 1 gun of each section.

ii. Attaching the line.

The reel will be removed from the box and the swivel hook will be clipped through the switch ring. To turn the light on or off, the line must be given a sharp pull.

iii. Securing the box.

In soft ground the hook will be released from its securing strap and stamped into the ground. On hard ground the securing chain will be used to anchor the box to a post or other suitable object.

2. Practise squad.

## LESSON 38A — NIGHT AIMING AND USE OF AIMING LAMP

### *Instructor's Notes*

*Stores:—*

*Gun tripod, night sights, aiming post, night aiming lamp.*

## 1. Night Aiming.

i. Description of night sights.

- (a) The night sights are carried in the aiming lamp box.
- (b) Explain the method of attaching the night foresight.
- (c) Explain method of attaching, and features of, the night backsight.

ii. To lay an aim with the night sights.

- (a) Instruction in aiming with the night sights will be carried out in the sequence given in Lesson 29, 3, i to iii. The aim with night sights will always be taken at a bull's-eye.
- (b) The No. 1 will be taught to place the forefinger of the left hand on top of, and at the right side of, the backsight. This is necessary in order to shut out light from the lamp over the top and between the backsight and the stem of the tangent sight. To lay a correct aim, the flat top of the blade which projects from the lower edge of the rectangular slit in the centre of the foresight will be used. The other features on the foresight may be ignored.

iii. To correct the line of sight.

No. 1 will make the necessary correction on the hand wheel and will then realign the sights by sliding the tangent sight slide up or down.



## 2. Use of the Night Aiming Lamp.

i. There are two types, Mark II and Mark III.

If the Mark III is in use, in combination with the clinometer, bar foresight, and night sights, one night aiming box is required per gun.

The Mark II box contains two aiming lamps, so that one box is required per two guns.

ii. Description of the Mark II lamp and box.

The folding handle on the side of the box must be opened before the box is opened. In removing the lamp it is necessary to take the lamp in one hand and the cable in the other to prevent the lamp being jerked and the connections carried away. In replacing, the word "TOP" on the lamps does not refer to their position in the box. Projecting strands of wire must not touch any terminal other than the one to which they are attached. No wire should touch terminals of the spare batteries.

iii. In paying out the cables from the drums:—

- (a) Speed should not be attempted.
- (b) Both should be unwound together.
- (c) No loose coils of cable should be allowed to loop round the ends of the drum.

iv. Method of attaching the lamp to the aiming post.

v. Lighting, dimming, and extinguishing the lamps.

- (a) The method of using the switch.
- (b) The switch must be turned off before the lamps are replaced in the box.

## LESSON 39 — DIRECTORS AND ANGLE OF SIGHT INSTRUMENT

### *Instructor's Note*

*Stores:—*

Directors and/or angle of sight instruments.

A. Director No. 4, Mark II (see plates 4 and 5).

1. Explain and demonstrate:—

### Focusing of telescope.

Pointer.

Degree scale on director.

### Clinometer level and elevating gear.

Degree scale plate.

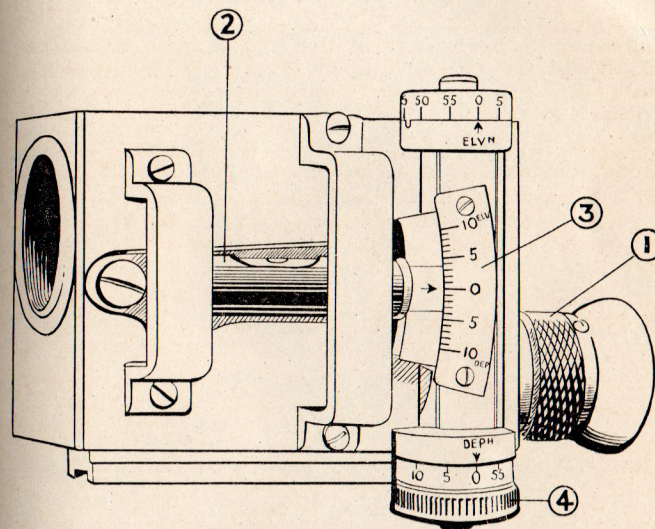
How to clamp the index plate and the functioning of the clamping screw.

Use of spirit level on stand.

Hook attached to base plate.

PLATE 4

DIRECTOR, No. 4. MARK II

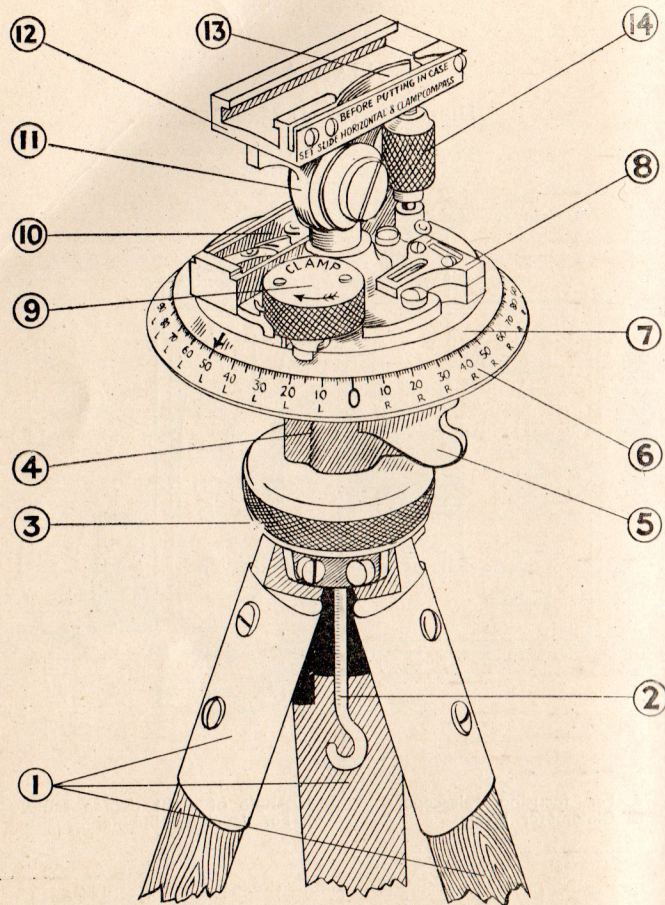


### KEY

1. For focusing telescope.
2. Clinometer level.
3. Angle of sight degree scale.
4. For levelling bubble.

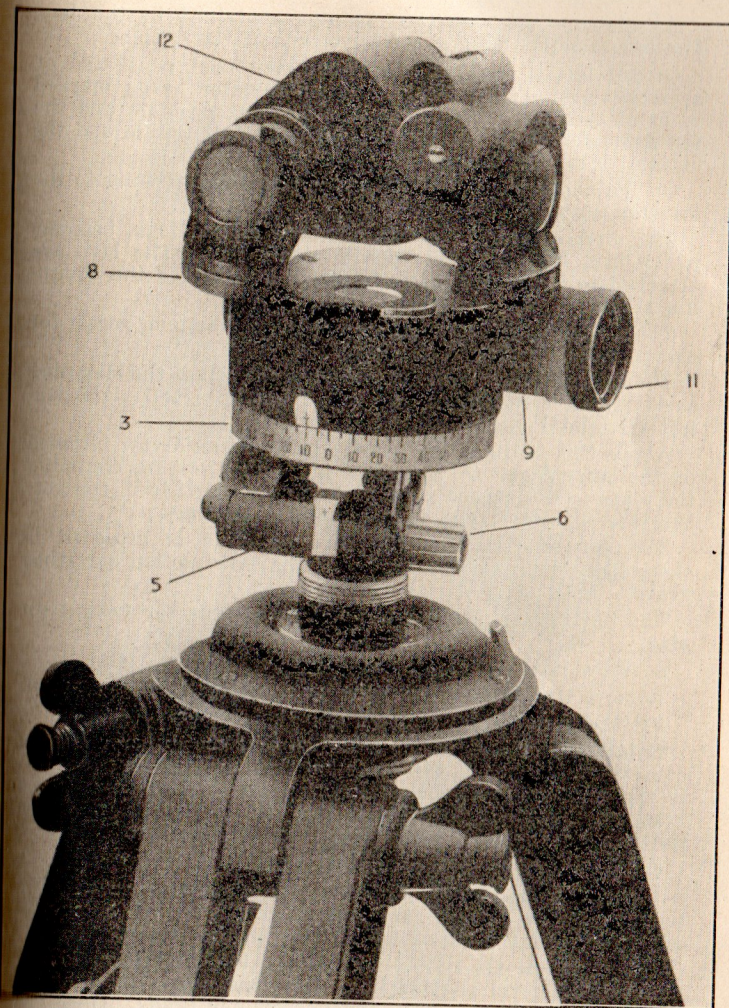


PLATE 5  
STAND DIRECTOR, No. 4, MARK II



## KEY

- |                        |                       |
|------------------------|-----------------------|
| 1. Legs.               | 8. Spirit level.      |
| 2. Hook.               | 9. Clamping nut.      |
| 3. Base plate.         | 10. Magnetic compass. |
| 4. Clamping socket.    | 11. Carrier bracket.  |
| 5. Clamping screw.     | 12. Carrier.          |
| 6. Degree scale plate. | 13. Side spring.      |
| 7. Index plate.        | 14. Elevating gear.   |



## DIRECTOR No. 9

- |                             |                              |
|-----------------------------|------------------------------|
| 3. Azimuth scale ring.      | 9. Bearing for worm spindle. |
| 5. Adjusting screw bearing. | 11. Micrometer drum.         |
| 6. Adjusting screw.         | 12. Telescope.               |
| 8. Body.                    |                              |



## 2. Describe how the instrument consists of:—

A telescope with vertical pointer contained in the box. The telescope can be focused by means of the eyepiece.

On the left of the box is a clinometer level, consisting of a bubble arm, degree scale, and micrometer heads marked in 5s of minutes. The top half of the degree scale and the top drum for elevation, the bottom half of the scale and the bottom drum for depression.

On the underside is a slider and spring for attaching to the director stand.

The director stand consists of three hinged legs, between which is a hook for use with a plumb line. The legs are attached to a circular plate, to which is attached the clamping socket.

The clamping socket rotates, and has a clamping screw for clamping the socket to the base.

The degree scale plate is attached to the top of the clamping socket, and is marked in degrees from 0 to 180 right and left (R. and L.).

Above this is the index plate, which has an arrow inserted on the outer edge. On this plate is a milled nut for clamping the plate to the degree scale plate, and a spirit level for getting the director stand upright, and a compass.

The carrier to which the director slide is attached is elevated or depressed by means of the slow motion elevating gear.

The springs on the carrier and slider are for taking up play.

## 3. Show how to set up the director.

Remove the director from the case, and the director stand. Fit the base of the director into the carrier.

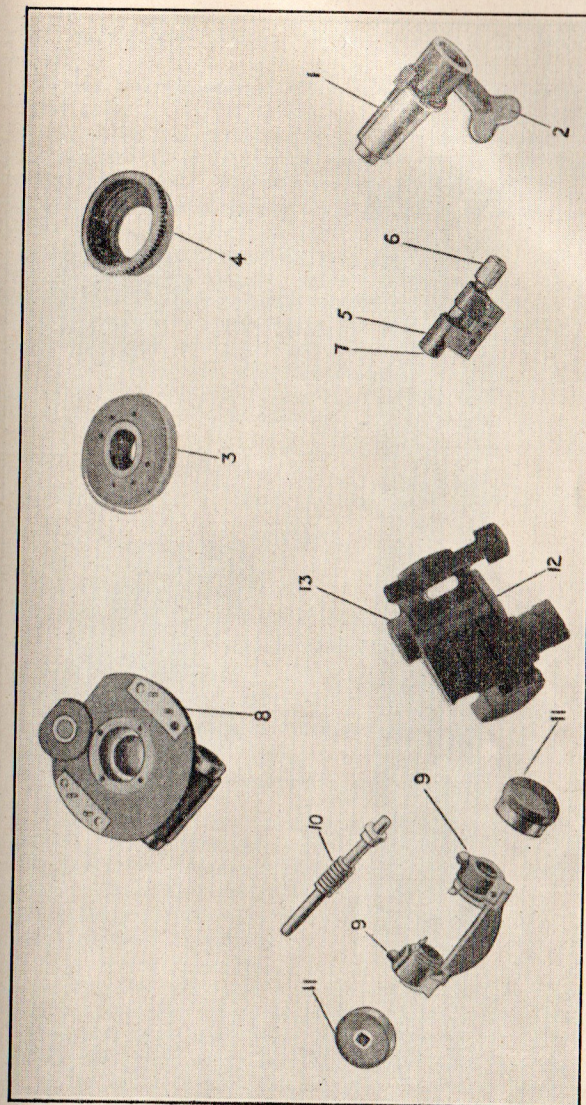
Splay out the legs of the stand so that the director is at a convenient height. It will be found that the kneeling position is the most suitable, but a lower position may have to be adopted. Press the legs firmly into the ground. Make sure that the degree scale plate is approximately level.

## 4. Show how to take an angle of sight.

Focus the telescope. Unloosen the clamping screw. By means of the elevating gear and milled portion of the clamping socket lay the tip of the pointer on the target.

By means of the milled head below the depression micrometer head, level the bubble. Read the angle of sight by means of the degree scale and micrometer heads. Once the bubble has been levelled, the reading of the angle of sight may be taken later at any convenient time. Readings to be to the nearest minute.

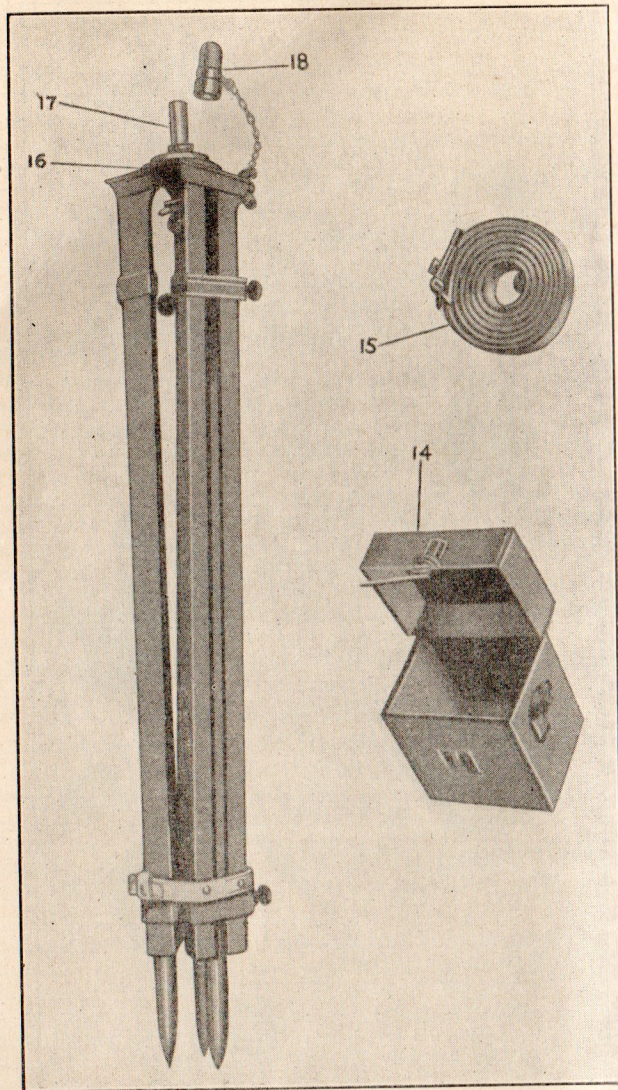
When finished with, the arrows will be set at zero.



COMPONENTS—DIRECTOR No. 9

- |                        |  |
|------------------------|--|
| 1. Pivot bearing.      | 7. Screwed plunger spring retaining cap. |
| 2. Gun metal screw.    | 10. Worm spindle.                        |
| 3. Azimuth scale ring. | 13. Object glass cap.                    |
| 4. Worm wheel.         |  |





14. Leather case.  
15. Shoulder strap.  
16. Base plate.

17. Ball joint.  
18. Protecting cap.

STAND—DIRECTOR No. 9

5. Explain how to measure the lateral angle between two points.

Set the pointer on the index plate opposite "Zero" on the degree scale.

Tighten up the clamping nut. By means of the elevating gear and milled portion of the clamping socket, lay the pointer on the first point. Tighten up the clamping screw.

Loosen the clamping nut and lay the pointer on the second point.

Read off the number of degrees and minutes, direction right or left, from the degree scale to the nearest 10 minutes. Ensure that the degree scale plate does not slip when the index plate is moved. Always move the index plate by holding the carrier bracket, and not the director.

Before putting the director stand in its case, set the slide horizontal, clamp the compass, and set the pointer on the index plate at 180 degrees.

6. Practise squad.

B. Director No. 9, Mark I (*see* plates 6, 7, 8).

1. Explain and demonstrate:—

Body.

Telescope.

Angle of sight graticules and hair line.

Clinometer level and levelling screw.

Director level.

Dial and degree scale.

Deflection drums and quick release.

Clamping nut.

Fine adjustment screw and centralizing pointers.

2. Describe how instruments consists of a body and a telescope. The telescope has graticules marked in 10 minutes, measuring up to 5 degrees above and below the centre, and a central vertical hair line. There is no focusing.

(In a later pattern the angle of sight graticules measure up to 4 degrees only.)

On top of the telescope is the clinometer level, which is a fixture with the telescope, and the clinometer levelling screw. The action of the latter is to bring the bubble central by bringing the telescope level.

Below the clinometer levelling screw and on top of the body is the director level, by which it can be ensured that the director is upright. At the bottom of the body is the dial which measures 0-180 degrees right and left, and which is normally set at 180 degrees.



In front of the body are the deflection drums, which enable the director to be turned about the dial. The angle of deflection is measured to 5 degrees on the dial, and in degrees and minutes by the appropriate deflection drum.

Each deflection drum and dial has its own pointer. Between the deflection drums is a quick release, which, by being depressed, enables the director to be turned about the dial, without the use of the deflection drums.

Below the body is a socket, by which the director is attached to a pivot on the stand. When attached, the director complete can be turned about the pivot, or clamped in the required direction by means of the clamping nut. Fine adjustments in direction can be made with the fine adjustment screw, below the left deflection drum. The two pointers alongside indicate when this is central.

3. Describe how stand consists of three legs of adjustable length. Adjustment is controlled by milled headed screws.

The legs are connected to a base plate by butterfly nuts.

In the centre of the base plate is a pivot connected to the former by a universal joint, and controlled by a universal joint clamping screw.

The pivot is protected by a metal screw cover.

4. Show how to set up director.

Undo the strap holding the legs together. By loosening the milled-headed screws extend the legs as necessary and tighten up the screws. Splay out the legs and mount the stand, with pivot at convenient height and approximately upright. If necessary tighten butterfly nuts.

Press the legs firmly into the ground.

Remove pivot protector and attach director. Ensure that fine adjustment screw is central.

Loosen the universal joint clamping screw and centralize director level bubble. Tighten universal joint clamping screw.

5. To show how to take an angle of sight (normal).

Lay at target through telescope, if necessary by elevating or depressing telescope with clinometer level screw.

Tighten clamping nut.

Level clinometer bubble, look through telescope and read angle of sight from the gratitudes. For accuracy this may entail bringing the gratitudes on to the target by means of the fine adjustment screw.

Readings to be within 2 minutes.

Check that clinometer level bubble is still central.

6. To show how to take an angle of sight of more than 5 degrees.

If angle of sight is more than 5 degrees plus, lay director at a convenient point immediately below the target and note the angle of sight. By using the gratitudes measure the vertical angle between this point and the target, and add the two angles together.

In the case of an angle of sight below 5 degrees minus take a convenient point above the target and proceed as before.

7. Explain how to measure the lateral angle between two points.

Set dial and deflection drums at zero.

Loosen clamping nut and lay director approximately at the first point. Tighten clamping nut, and bring hair line on to first point by means of the fine adjustment screw.

Using deflection drums, and if necessary the quick release, bring hair line on to second point.

Read degrees off dial and degrees and minutes off the appropriate deflection drum. Readings to be to the nearest minute.

Before putting director in its case centralize fine adjustment screw, and put dial pointer at 180 degrees and deflection drums at zero.

8. Practise squad.

C. Angle of sight instrument.

1. The instrument consists of a brass box forming a prismatic telescope, the eyepiece of which is so arranged that besides the view a spirit bubble together with a vertical and a horizontal cross line can be seen. These two lines intersect each other at the centre of the field of view. The bubble can be inclined to the line of sight and the inclination read off degree and minute scales:—

Magnification—4 diameters.

Field of view—4 degrees horizontal by 5 degrees 30 mins. vertical.

Weight of instrument in case—1 lb. 8 ozs.

Overall dimensions of case—5½ ins. by 4 ins. by 2¼ ins.

2. It consists of the following parts:—

The brass body (A) is fitted internally with guides for the supporting plate (B). A flap (C) is hinged to the rear end and holds the eyepiece adapter (K) and eyepiece (D). It is kept in position by the screw (E). A glass window (F) admits light to the bubble. The two serrated discs (G) are for the fingers of the left hand to rest on, when taking angles. A light gunmetal



slide at (H) is fitted to the base of the instrument, which enables it to be mounted on the Stand, No. 4 Director, Mark I. It can then be used as a director for measuring angles in horizontal and vertical planes.

The object glass is mounted in front of the body and a ray shade (J) fits over it. It consists of two lenses balsamed together, and is adjusted so that the vertical and horizontal cross lines on the prism (M) are in its focal plane.

The eyepiece (D) fits in the eyepiece adapter (K), and is focussed by sliding it backwards or forwards, and not by twisting it. It has two lenses, the front one is cut away for a third of its breadth so that the view, which is seen through both lenses, and the bubble, which is seen through the rear one only, are in focus simultaneously.

The supporting plate (B) fits accurately in the guides in the body. A small projection (Bi) is formed on it to facilitate withdrawal.

On the left side are mounted two double reflecting prisms (L, M), the latter having a vertical line and a horizontal cross line engraved on its rear surface, and a mirror (N) in which the reflection of the bubble is seen.

A pivot passes through the plate, and on it are mounted a cased spirit bubble (O) and an arc (P). The bubble, which is sensitive to a movement of between 4 mins. and 5 mins. is supported on the bubble bracket (Y) by two screws, which allow of it being adjusted if the degree and minute scales do not correspond. The arc has teeth cut on it, which gear with the worm spindle (Q), and a projection (Fi), on which an arrow for reading the degree scale is engraved.

Play is taken up by the spiral spring (R).

Attached to the plate is the degree scale (S) with graduations in single degrees from 0 degrees to 15 degrees elevation and 10 degrees depression, the latter being filled in white on black.

The worm spindle (Q) is fitted in bearings, and is squared at its upper end to take the milled head (T), beneath which is an adjustable skin (U). The latter is graduated every 5 minutes, numbered every 10 minutes in both directions, and coloured to agree with the degree scale. It can be loosened for adjustment by slackening the two screws (V).

3. Case.—The leather case is suitably fitted and padded and has a shoulder strap fitted to it.

4. Earlier Patterns.—Certain early patterns of this instrument differ from the Mark II in that the base plate (H) does not permit of the instrument being mounted on a director stand, and in some instances the degree scale (S) reads from 15 degrees elevation to 5 degrees depression, and the case is not padded.

5. To Take an Angle of Sight.—Mount the instrument on the director stand. Focus the instrument by sliding the eyepiece backwards and forwards. Loosen the "butterfly-shaped" clamping screw on director stand. Lay the intersection of the cross-wires by means of the elevating gear and milled portion of the clamping socket on the director stand, at 6 o'clock on the target.

Turn the micrometer head (T) with the right hand until the centre of the bubble is opposite the right end of the horizontal line etched on the large prism.

Read the angle of sight off the degree scale (S) and the corresponding minute scale (U).

Angles of sight may be taken holding the instrument in the left hand if a director stand is not available. It is advisable to rest the instrument, if possible to obtain steadiness. Take the mean of three readings under such conditions.

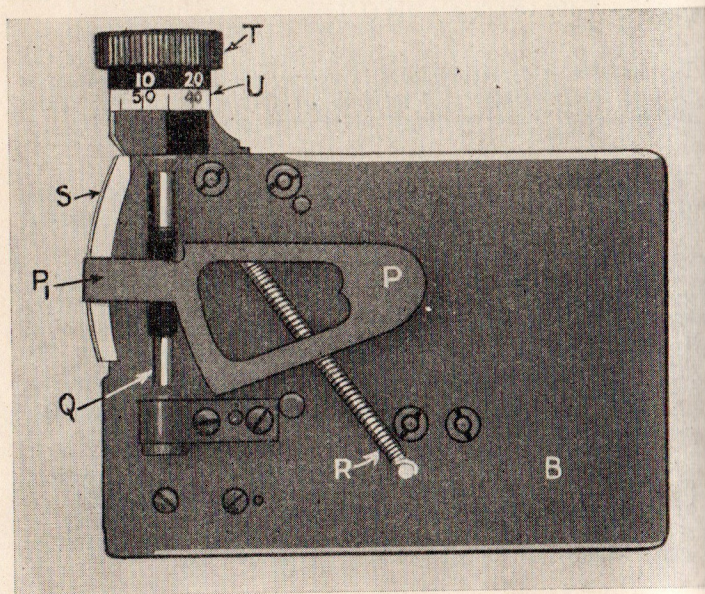
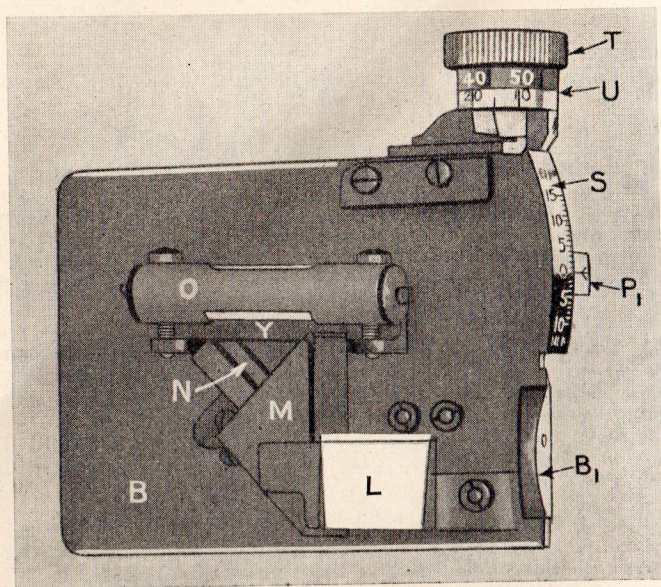
6. To Measure a Lateral Angle between Two Points.—Set the pointer on the index plate of the director stand opposite "ZERO" on the degree scale of the stand.

Tighten up the clamping nut. By means of the elevating gear and milled portion of the clamping socket lay the intersection of the cross wires at 6 o'clock on the first point. Tighten up the "butterfly-shaped" clamping screw on the director stand.

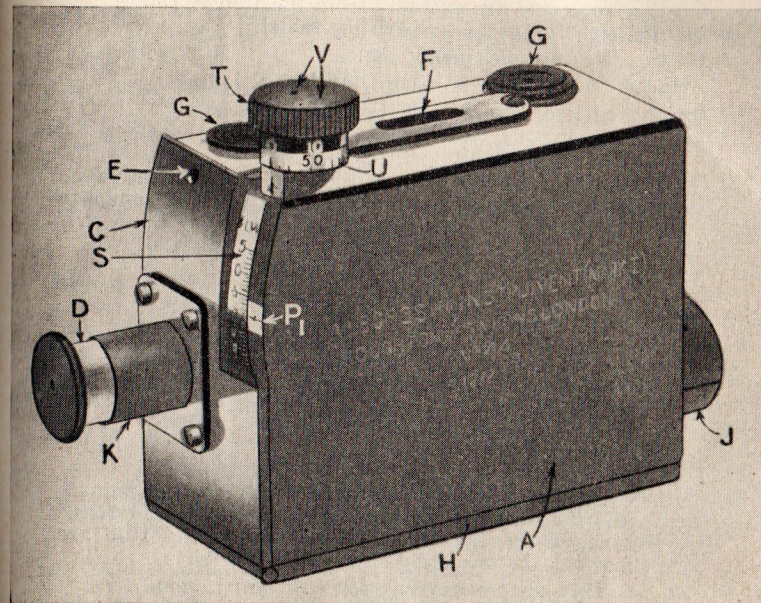
Loosen the clamping nut and lay the cross wires on the second point.

Read off the number of degrees, minutes, and direction, right or left, from the degree scale. For further details, see Lesson 39, where, although the detail refers particularly to the director, No. 4, Mark II, the method of use is similar when employing an instrument, angle of sight.





SUPPORTING PLATE, RIGHT SIDE (Internal)

SUPPORTING PLATE, LEFT SIDE  
(Internal)

NOTE.—The above illustrations are of the Mark I, the only difference between the Mark I and Mark II is the base plate H—the Mark II having a gunmetal slide in lieu of the aluminium plate in the Mark I.



## LESSON 40—SLIDE RULE, M.G., MARK IV

*Instructor's Note**Stores:—**Slide rules.*

## 1. Description.

On the front side are extracts from the Range Tables, and a blank space for use as a writing tablet.

On the sides are measuring scales.

Attached to the rule is a cord, 24 inches long.

On the back of the rule is the following:—

## i. Safety angle scale.

On the right centre of the rule is marked a range to target scale, and on the right slide a range to troops scale.

## ii. Degree scale.

On the right side of the right slide is a degree scale and on top of the rule is a line.

To use:—To measure angular widths—when the rule is held at the length of the cord from the eye, the amount of slide projecting at the top of the rule will cover on the ground the amount in degrees and minutes shown opposite the line.

## iii. Wind scale.

On the reverse of the right slide are the minute allowances. On the right of the rule is the range scale. On each side of the slide on the rule are marked the wind directions as clock rays.

This scale is marked for a 10 m.p.h. wind.

To use:—Place the arrow on the slide opposite the range to target. Opposite the appropriate wind direction lines read the range and/or line corrections in minutes.

## iv. V.I. scale.

On the left side is marked the H.E. scale and an arrow. On the rule is marked the V.I. scale and a degree scale.

To use:—With a known V.I. and H.E. the angle subtended can be found by setting the H.E. on the sliding scale opposite the V.I. on the fixed scale. The angle can be read opposite the arrow on the right of the slide. The V.I. or H.E. can be found in a similar manner when the remaining factors are known.

## v. Conversion of metres to yards.

On the left column of the rule, near the bottom, is an arrow marked "Metres to Yards."

To convert metres to yards:—

Slide the left hand slide up until the figure 100 on the H.E. scale is opposite this arrow. Follow the H.E. scale up to the required number of metres. Read the figure opposite this on the V.I. scale. Multiply the figure on the V.I. scale by 10 to find the number of yards.

## vi. Displacement scale.

On the reverse of the left slide is the conversion scale marked in degrees, and on the left centre of the rule is a degree scale.

To use:—Place the angle TOG opposite the oblique base (on the V.I. scale) and read the true base from the 90 degree index.

The range correction can also be obtained by adding 90 degrees to the angle TOG, when O is behind the gun position, or subtracting 90 degrees from the angle TOG, when O is in front of the gun position.

Place this angle opposite the oblique base on the V.I. scale; the resultant reading from the 90 degrees index will be the range correction (*see* Lesson 109).

Reverse the slide—place the range to target (H.E. scale on slide) against the true base (V.I. scale) and read off the angle by the arrow on the right. This is the angle by which the director setting differs from 180 degrees. The angle at which the director must be set is also shown against the arrow.

## 2. Practise squad.

## LESSON 40A—SLIDE RULE, M.G. MARK III

*Instructor's Note**Stores:—**Slide rules.*

## 1. Description.

On the front side are extracts from the Range Tables.

On the sides are measuring scales.

Attached to the rule is a cord, 24 inches long.

On the back of the rule is the following:—

## i. Safety angle scale.

On the right centre of the rule is marked a range to target scale, and on the right slide a range to troops scale, up to 500 yards in red and over 500 yards in black.



## ii. Degree scale.

On the right side of the right slide is a degree scale and on top of the rule is an arrow.

To use:—To measure angular widths—when the rule is held at the length of the cord from the eye, the amount of slide projecting at the top of the rule will cover on the ground the amount in degrees and minutes shown opposite the arrow.

## iii. Wind scale.

On the reverse of the right slide are the minute allowances. On the right of the rule is the range scale. On each side of the slide on the rule are marked the wind directions.

This scale is marked for a 20 m.p.h. wind.

To use:—Place the arrow on the slide opposite the range to target. Opposite the appropriate wind direction lines read the range and/or line corrections in minutes.

## iv. V.I. scale.

On the left slide is marked the H.E. scale and an arrow. On the rule is marked the V.I. scale and a degree scale.

To use:—With a known V.I. and H.E. the angle subtended can be found by setting the H.E. on the sliding scale opposite the V.I. on the fixed scale. The angle can be read opposite the arrow on the right of the slide. The V.I. or H.E. can be found in a similar manner when the remaining factors are known.

## v. Displacement scale.

On the reverse of the left slide is the conversion scale marked in degrees, and on the left centre of the rule is a degree scale.

To use:—Place the angle T.O.G. opposite the oblique base (on the V.I. scale) and read the true base from the 90 degree index.

The range correction can also be obtained by adding 90 degrees to the angle T.O.G., when O is behind the gun position, or subtracting 90 degrees from the angle T.O.G. when O is in front of the gun position.

Place this angle opposite the oblique base on the V.I. scale; the resultant reading from the 90 degrees index will be the range correction (*see* Lesson 109).

Reverse the slide—place the range to target (H.E. scale on slide) against the true base (V.I. scale) and read off the angle by the arrow on the right. This is the angle by which the director setting differs from 180 degrees. The angle at which the director must be set is also shown against the arrow.

## 2. Practise squad.

## LESSON 41—PLOTTER M.G. AND RESECTOR PROTRACTOR

*Instructor's Note*

*Stores:—*

*Plotters M.G. and resector protractors.*

**A. Plotter M.G.**

## 1. Explain and demonstrate:—

Scales on base.

Range arms.

Protractors, and vernier scale.

Use of clamping screws.

## i. Description.

The plotter consists of a base of two slides, marked on the inner side in yards.

On each slide is a semi-circular protractor marked in degrees, from which run the range arms marked in yards, and tangent elevations.

For use with each scale is a clamp and a pointer.

The following will be explained:—

## ii. To use the plotter.

The plotter is used to solve triangles.

From it, given two sides and the included angle, the other angles and the third side can be found.

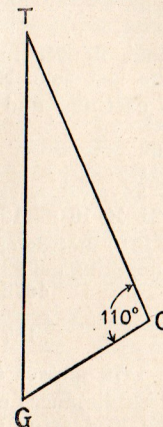


FIG. 2



In the triangle TOG, Fig 2, suppose OG to be the base (600 yards) and suppose TO to be the range (1,600 yards) and the angle TOG to be 110 degrees.

To find the angle TGO and TG:—

Loosen all clamps and draw out the slides on the base until the arrow on the right of the protractor can be set at 600 yards.

Clamp up the clamping screw on the base.

Move the arrows on the slide of the range arm to 1,600 yards and clamp up the screw. Move the range arm until 110 degrees on the protractor is opposite the arrow on the centre of the base plate. Clamp up the screw.

Reverse the plotter. Read the angle TGO from the other protractor (52 degrees 40 mins.) and TG from the range arm (1,895 yards).

NOTE.—The Plotter, Field, Mk V, is similar in construction to the M.G. Plotter, but is not fitted with a vernier scale. It is manipulated in the same manner as the M.G. type, except that the base and range settings must be doubled and the resultant range figure halved. This is necessary on account of the limited "base scale."

iii. To find the range to the target, using the map.

Take the 8-figure co-ordinate of the pivot gun and the target.

e.g. Pivot gun	..	93414859
Target	..	94624672

The first four figures in each case are called Eastings and the last four Northings.

Subtract the eastings and multiply the answer by 10.

9462
9341
—

$$121 \times 10 = 1210.$$

The target is 1210 metres east of the pivot gun.

Subtract the northings	4859
	4672
	—

$$187 \times 10 = 1870.$$

The target is 1870 metres south of it.

Set one of these distances on the base of the field plotter. Set the protractor on the field plotter at 90 degrees.

Set the other distance on the range arm.

Turn the plotter over and read the range on the reverse arm.

This will be the range gun—target in metres:  
e.g. 2225 metres.

To convert to yards, multiply by 11 and divide by 10, or use the slide rule.

3. Practise the squad.

## B. Resector Protractor.

### 1. General description

The instrument consists of:—

A *protractor*, graduated from right to left, and from left to right in degrees and containing *romers* for scales of 1/20,000, 1/25,000 and 1 inch to 1 mile (1/63,360), and three pin holes.

A *fixed arm* containing graduations in hundreds of yards for a scale of 1/25,000, a scale of angles of sight in minutes, and two pin holes.

A *lower pivoting arm* with graduations in hundreds of yards for a scale of 1/10,000, a scale of angles of sight in minutes, and two pin holes.

An *upper pivoting arm* with a scale of 1/63,360 (1 inch to 1 mile), and two pin holes.

A *clamping screw* with *pencil hole*.

### 2. Methods of using the resector

A. *To resect the position of the pivot gun for a map shoot.*  
(See S.A.T., Vol I, Pamphlet No. 7, Part III, sec. 27, para. 4.)

Select three points on the ground which are also marked on the map. (For the best results, these points should be so selected that the angle subtended by any two of them at the gun is not less than 90 degrees.)

Place a director at the position of the pivot gun. Set the director dial at zero, and lay an arc of these points (point A). Clamp up the director dial and swing the director on to point B. Read the angle AGB subtended at the pivot gun by points A and B. Similarly find the angle (AGC) subtended by points A and C.

(These angles may also be found using a gun with a dial sight in place of the director. The dial will be set at zero and the gun laid on point A.)

Set the angles AGB and AGC on the resector by means of the pivoting arms, if necessary using the "tail" of one of the pivoting arms. Tighten the clamping screw. Place the resector on the map, and move it about until the bevelled



edge of the fixed arm is on point A, the bevelled edge of the pivoting arm set at the angle AGB is on point B, and the bevelled edge of the pivoting arm set at the angle AGC is on point C. Care must be taken that the eye is directly over the bevelled edges of the pivoting arms when setting the resector in position. The position of the pivot gun is then in the centre of the pencil hole, and may be marked on the map by a sharp-pointed pencil.

To find the accurate map reference of this point, use the romer for the appropriate map scale. (See Manual of Map Reading, 1929, sec. 49.)

## SECTION 10 — INSTRUMENT TESTS

### LESSON 42 — METHOD OF TESTING THE LEVEL OF THE DIAL SIGHT, USING THE CLINOMETER VICKERS, MK. III

*Stores required:—*

*Gun, dial sight, clinometer.*

1. This check will be carried out by the section commanders periodically, and whenever a new dial sight or gun is received.

- i. First ensure that the clinometer is in adjustment. If not, it will be tested and adjusted as laid down in Lesson 42A.
- ii. Set the scale to zero.
- iii. Place the dial sight on the gun and clamp up the screw. Zero the drums and dials.
- iv. Open the rear cover and place the clinometer on the breech casing, making sure that the arrow is pointing to the front of the gun.
- v. Elevate or depress the gun by means of the hand-wheel, until the *clinometer* bubble is in the centre of its run.
- vi. Inspect the dial sight bubble. If it is central the dial sight is in *adjustment for that particular gun*. If it is not central, bring the bubble to the centre of its run *by means of the angle of sight drum*. Note the angle and whether it is plus or minus. This is the amount by which the dial sight is out of adjustment.

2. The error will be rectified by the armourer.

3. If it is not possible to have the dial sight adjusted prior to firing, then according to whether the error is minus or plus, it must be added or subtracted by the No. 1 from the elevation ordered by the fire controller.

It is therefore necessary to attach a tally to the dial sight showing the amount of correction required, until such time as the adjustment has been carried out.

NOTE.—Reference para. 1. If it is not practicable to get the clinometer put into adjustment, the dial sight can still be tested by a clinometer, the bubble of which has been centralized, as described in Lesson 42A, 1, Appendix I.

4. Practise squad in above test.

5. Explain and demonstrate:—

Direction.

The collimator sight will be zeroed for line at the same time as the lateral adjustment of the foresight on the 30 yards range.

This process is carried out in the following way:—

A thick line is drawn parallel to, and 3.4 inches to the left of, the thin line on which the shots fall. If, when the M.P.I. of the group fired falls on the thin line, the tip of the pyramid coincides with the thick line, the collimator is in adjustment.

As an alternative test without firing, the gun will be laid on a distant target by means of the tangent sight, and, if the collimator, with all the scales set at zero is also laid for line on this target, it is in adjustment.

6. Practise squad.

7. Explain, without demonstration.

To adjust.

If the collimator requires adjusting, it is carried out in the following manner:—

Loosen the screws below and to the sides of the ramps. Tighten the appropriate screw until the line of sight is 3.4 inches to the left of the barrel and lock in position by tightening the other screw.

NOTE.—This adjustment should be carried out by an armourer only, but may in emergency be carried out by an experienced N.C.O.

### LESSON 42A — TESTING AND ADJUSTING THE CLINOMETER

*Instructor's Note*

*Stores:—*

*Gun, tripod, clinometer.*

1. To test the clinometer

i. Set the scale to zero.

ii. Place the clinometer on the gun, elevate or depress until the bubble is in the centre of its run.



- iii. Reverse clinometer and note the position of the bubble.
  - (a) If central, the clinometer is in adjustment, but confirm, say, 10 degrees depression and 10 degrees elevation.
  - (b) If displaced, this indicates that an error is present.
- iv. In the case of (b) leave the clinometer on the gun and rotate the minute scale until the bubble is again central, then note the scale reading.
- v. Having noted the variation from zero, halve it and set the scale to this point, e.g., suppose that the reader points to 20 minutes E, remove clinometer and set scale to 10 minutes E.
- vi. Replace on the gun and proceed as in ii. and iii. above; if the bubble does not come central repeat the process.

NOTES.—1. When rotating the minute drum always turn to the left last, i.e. anti-clockwise. Should an error be found, it will be seen that when the clinometer is truly horizontal there will be a variation in the zero reading. This error will be noted and the instrument adjusted as soon as possible.

2. If a gun is levelled with a clinometer known to be in adjustment, then any number of clinometers can be tested by placing them on the gun in the ordinary way, and noting if there is any error.

## 2. To adjust the clinometer

Set the clinometer at the error noted. With the spanner loosen the "nuts securing micrometer collar," set the scale to zero and tighten up.

If the variation is large, it may be necessary to reset the degree reader. This is done by loosening the two securing screws and sliding the reader to the right or left, and then clamping up.

NOTE.—Except in an emergency, adjustments will be carried out only by armourers.

## LESSON 43—TESTING THE NO. 4, MARK II, DIRECTOR FOR ANGLE OF SIGHT

### *Instructor's Note*

*Stores:—*

*Gun, tripod, dial sight, director.*

1. Mount a gun and attach a dial sight which is known to be in adjustment, and lay with the tangent sight at zero (O) on a distant object. With the range drum of the dial sight at zero, level the bubble by means of the angle of sight drum, and note the reading.

Mount the director at the same height as the gun (i.e. the object glass to be on the same horizontal plane as the tangent sight). Place the angle read from the dial sight, on the director. Lay the director on the distant object, and, if the bubble is not then central, the director is not in adjustment. Note the amount of error by centralizing the director bubble by the micrometer head.

2. If a horizontal line is available, place the object glass at one end of the horizontal line (with the degree and minute scales at zero), and lay the pointer by means of the elevating gear, at the other end of the line.

The bubble should then be central; if it is not, turn the micrometer head until it is, and note the error.

## 3. To lay out a horizontal plane, and test director for angle of sight.

i. Select a position where there are two walls or upright posts, about 200 yards apart, and as far as possible in the same horizontal plane.

ii. Take director to one wall (A), if possible a corner of a house. Lay director at the other wall (B), and instruct an assistant to make a mark on (B), which appears to be the angle of sight (i.e. an angle of sight of zero).

Make a mark on (A) level with the object glass.

iii. Take director to (B), mount it with object glass level with the mark, and lay it at mark on (A).

(a) If mark on (A) has no angle of sight, the two marks are on the same horizontal plane and the director is in adjustment.

(b) If the mark on (A) appears to show an angle of sight, make a second mark which has not.

(c) By measurement, make a third mark (X) on (A), midway between the two existing marks. (X) is on the same horizontal plane as the mark on (B).

iv. (a) Any director may now be tested for angle of sight and the errors, if any, noted.

(b) Adjustments will only be made by an armourer.

## 4. Practise squad.

NOTE.—Where an adjustment is necessary, it will be carried out by an armourer.



## LESSON 44 — TESTING THE NO. 9, MARK I, DIRECTOR FOR ANGLE OF SIGHT

### *Instructor's Notes*

*Stores:—*

*Gun, tripod, dial sight, director.*

1. Mount a gun, attach a dial sight known to be in adjustment, and lay with the tangent sight at zero (0) on a distant object. With the range drum of the dial sight at zero, level the bubble by means of the angle of sight drum, and note the reading.

Mount the director at the same height as the gun (i.e. object glass on the same level as the tangent sight), and take angle of sight to distant object.

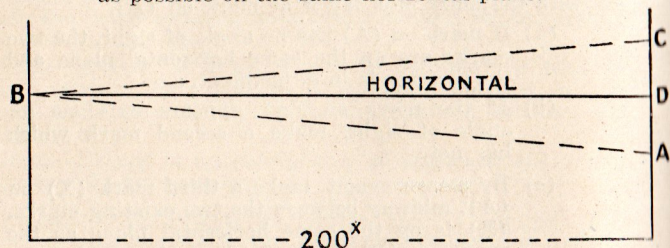
If this angle is the same as the reading on the angle of sight drum the director is in adjustment. If not, note the amount of error.

2. If a horizontal line is available, place the object glass at one end of the horizontal line and take the angle of sight to the other end. If this is zero the director is in adjustment, if not, note the error.

## LESSON 45 — TO TEST AND ADJUST THE ANGLE OF SIGHT INSTRUMENT

1. Lay out a horizontal line. This is done as follows:—

- i. Select a position where there are two walls or upright posts, and about 200 yards apart, and as far as possible on the same horizontal plane.



- ii. Take the instrument to one wall (A), if possible at the corner of a house. Set the angle of sight scale to zero, direct the telescope at the other wall and bring the bubble to the centre of its run. Look through the telescope and direct someone to mark the point where the cross-wire cuts through the distant wall (B). Mark the wall where you are standing at (A) the same height as the object glass of the instrument.

- iii. Take the instrument to the distant wall (B) and place the object glass against the mark (B) made on it. Still keeping the angle of sight scale at zero, bring the bubble to the centre of its run. If the instrument is in adjustment the cross-wire should be in line with the mark (A) on the first wall and the line between the two marks is in a horizontal plane.
- iv. If such is not the case direct someone to mark on the first wall (A) another point (C) on which the cross-wire is layed, the bubble being central.
- v. Make a third mark (D) on the first wall exactly halfway between (A) and (C).
- vi. With the instrument still at (B) on the second wall elevate or depress the telescope until the cross-wire is layed on the third mark (D). While keeping it layed on this point rotate the micrometer head of the instrument until the bubble is again in the centre of its run.
- vii. Without altering the readings take the instrument to (D) and check the adjustment back on (B). If correct, a line between these marks is in the same horizontal plane.

When once a horizontal line has been obtained any number of instruments can be checked and adjusted on it.

2. Having now layed out a horizontal line, proceed to adjust the instruments. Set the degree and minute scales to zero. Place the object glass at one end of the horizontal line and lay the right end of the cross-wire in the instrument on the point at the other end of the line layed out.

The centre of the bubble should then be in line with the horizontal cross-wire in the instrument.

3. If it is not, turn the micrometer head until it is so. Loosen the two small outer screws on the top of the micrometer head and rotate the "minute skin" until it reads zero. Tighten up the screws.

4. If the degree scale is found to be more than a few minutes off zero, it will be necessary to start afresh and manipulate the screw supporting the cased bubble until, the scales being at zero, the horizontal cross-wire in the instrument is layed on the distant point in the same horizontal plane, and at the same time is opposite the centre of the bubble.

This is a delicate operation and can only be carried out by an expert, as there is danger of damaging the mechanism and smashing the bubble glass.



## APPENDIX I

## 1.—Foresight bar, deflection, Mark I

(Plate I)

The sight is of steel and consists of:—

- i. A bar (A) about 10 inches in length, graduated in intervals of 10 minutes and degrees up to 7 degrees right and left of the centre line.
- ii. An inverted U-shaped bracket (B) to which the bar is a fixture and which is arranged to assemble over the protecting wings of the ordinary gun foresight, where it is secured by a screw (C) in the left side of the bracket and a spring stud (D) in the right, the former engaging in the hole in the left wing and the latter in the opening in the right wing.

The upper surface of the bracket (E) is graduated in ten-minute intervals, in continuation of the graduations on the bar, the centre line being indicated as zero.

- iii. The sliding sight (F) with clamp screw (G) for fixing in any desired position on (A).

The sight has a central blade and protecting wings, and is arranged to take night sights when required for night firing.

Two pointers (H) are provided on the slide to register respectively with the scale on (A) and on (B).

When assembling the sight, care must be taken that excessive pressure is not applied to the screw, as such will distort the sight protecting wings of the gun, and thereby affect the level of the bar.

## 2.—Post, aiming, M.G., Mark I.

The aiming post consists of a single telescopic stand, the top half of which can be raised or lowered.

The base of the stand is a metal plate with three spikes. The plate enables the spikes to be pushed into the ground by means of the feet, and also prevents the stand sinking too far in soft ground.

The lower half, or tube, of the aiming post has a clamping screw at the top which allows the top half to be fixed at the required extension.

The top half, or inner rod, is surmounted by a bracket, to one side of which a day aiming mark (black bullseye on a white background) is permanently fixed. The other side of the bracket provides a support for the night aiming lamp when in use. On the inner rod is a collar and clamping screw which allows this rod to be maintained at a given height when rotated.

By this means the aiming lamp can be set at the same height as the day aiming mark if desired.

## 3.—Clinometer, Vickers .303 in. M.G., Mark I.

(Plate II)

1. Description.—This instrument consists of a manganese bronze casting called the "cradle" (A). The upper surface is cut to form the arc of a circle in which the arc (N) can slide, and to the lower surface is attached a cast steel base (B) adapted to rest between the side plates of the gun when the rear cover is raised.

A scale of degrees (C) from zero to 20 degrees elevation and depression is engraved on one face and is read from an arrow (D) on the arc. The graduations for elevation and depression are filled in with black and are numbered every 5 degrees and followed by the letters "E" and "D" respectively.

A worm spindle is fitted in two bearings in the cradle, one end (E) being on a pivot. This allows the worm to be put out of gear with the arc, for quick setting, by pressing downwards on the other end (F) of the worm spindle.

A spring is provided to keep the worm spindle and arc in gear.

Two micrometer collars are fixed to the worm spindle, one (G) for reading depression in minutes, the other (H) for reading elevation in minutes.

The micrometer collars are divided every five minutes and numbered every ten minutes, and are coloured the same as the degree scale. The figures on the micrometer collars have the letters "E" and "D" engraved underneath to indicate elevation and depression respectively.

At one end of the worm spindle a milled head (J) is firmly attached; one turn of this milled head represents one degree.

The arc (N) is shaped to slide in the cradle. On its under surface are teeth into which the worm gears. Attached to it by two screws is an adjustable reader (K) for the degree scale. On its upper surface is attached a spirit-level (L).

Engraved on the base is an arrow (M) and the word "Target." This is to indicate the correct direction in which to place the clinometer on the gun.



#### 4.—Director, No. 4, Mark II

(For Plates, see Lesson 39)

##### 1. Description.—This instrument consists of:—

- i. The telescope (which is of the prismatic type and is contained in a rectangular aluminium box (A).

Magnification, 6 diameters;

Field of view, 8 degrees 24'.

Effective aperture of object glass—1.2 inches.

A vertical pointer is mounted in the focal plane of the object glass.

- ii. The **clinometer level** consists of a bubble arm, pivoted to the front end of the telescope body and having a worm arc cut on its rear end. A reader for the degree scale is engraved on its rear end.

A bubble spirit glass is mounted on this arm. It can be adjusted by turning a large capstan-headed screw which passes through the front end of the bubble casing.

A worm spindle, having micrometer heads (elevation) and (depression) graduated in divisions of five minutes, gears with the arc on the bubble arm. It is kept up to its work by a flat nickel alloy spring; the micrometers are not adjustable.

A degree scale graduated from ten degrees elevation to ten degrees depression is attached to the telescope body. The graduations of elevation scales are filled with black and those for depression with red. Two projecting pieces protect the bubble from damage.

- iii. The **slider** is attached beneath the telescope. It is shaped to fit into the "Stand, No. 4 director."

A flat nickel alloy spring beneath it takes up all up-and-down play between the director and the stand.

The weight of the instrument is two pounds.

The stand consists of:—

- iv. A **tripod** having mahogany legs with steel shoes. The legs are hinged to a base plate around the upper end of which the clamping socket can revolve. An anchoring hook, to which a steadying weight can be attached, is screwed into the base plate.

The lower end of the **clamping socket** is roughened so that a good grip of the fingers can be obtained when it is being revolved. The clamping screw, when tightened up, clamps the clamping socket to the base plate.

To the top of the clamping socket is attached, by screws, the **degree scale plate**. The rim of this plate, which is made of nickel alloy, is graduated in both directions from 0 to 180. "Right" and "Left" are indicated by "R" and "L" beneath each number.

Pivoted to the degree scale plate is the **index plate**.

A small piece of nickel alloy, upon which an arrow for reading the degree scale is engraved, is let into the plate. Upon the index plate are mounted a "bubble, spirit, cased, No. 1," and a **magnetic compass**. The needle of the compass can be raised from, or lowered on to, its pivot by means of a slide, which is not shown in the plates. The index blocks of the compass can be adjusted by turning two small screws.

The **clamping nut** clamps the degree scale plate to the index plate by means of an internal clamping ring.

Attached to the upper surface of the index plate is the **carrier bracket**, to which is pivoted the **carrier**. The carrier is shaped to take the base of the No. 4 director. A stop prevents the insertion of the director from the wrong end, and a side spring of nickel alloy takes up side play.

A **slow motion elevating gear**, consisting of a nut and right and left-handed screws, which are attached to the index plate and carrier, allows the director to be moved smoothly between 25 degrees elevation and 18 degrees depression.

The weight of the stand is eight pounds.

#### 5.—Sights, night, Vickers .303 in. M.G.

(Plate I)

1. The **foresight** consists of a vertical, rectangular, sheet steel plate,  $1\frac{1}{8} \times 2\frac{3}{8}$  inches, shaped and pierced to form sighting features, and mounted upon a steel body with spring arms, by means of which it is attached to the protecting wings of the sliding sight of the deflection bar foresight. It can also be attached to the foresight bracket of the gun if required.

The sighting features consist of a barley-corn, formed centrally on the upper edge; below this is an aperture; then a rectangular opening having an inverted barley-corn projecting from its upper edge, and a combined aperture and blade from its lower edge, whilst a notch is cut in each side to indicate normal limits of traverse, the spacing being equal to about one degree of angle in each direction.



The foresight is assembled to the sliding sight of the deflection bar foresight by being sprung on to the protecting wings from the side which faces the breech of the gun.

2. The **backsight** consists of a vertical rectangular steel plate about  $1\frac{1}{8} \times 1\frac{1}{8}$  inches, pierced to form a sighting aperture about  $\frac{1}{8}$  inch in diameter, and below, to the right and left of the aperture, two small rectangular openings behind which a background of luminous paint can be employed if required as a guide to the position of the aperture.

The plate is secured to a small steel body, to which is attached a spring clip for engagement with the tangent sight slide of the gun.

The backsight is assembled to the slide by pressing it on to the projecting blade portion from the left, care being taken to see that the horizontal ledge of the body rests on the upper edge of the blade, and that the bent lip on the right side of the spring engages over the inner edge of the slide.

## 6.—Lamps, aiming, M.G., Mark II

### 1. Description.—

The lamps are contained in a wooden box, there being two lamps in each box. On the side of the box is a folding handle.

In the lid of the box is a drum on which is wound a separate cable for each lamp. This drum is operated by the folding handle.

In the box is the battery and a spare battery, held in place by an ebonite strip and a screw. On the side of the compartment for the batteries is an adjustable resistance for regulating the amount of light shown by the lamps.

Next to the batteries is the switch. Either lamp can be illuminated by moving the switch to one of the points marked 1 and 2 on either side of the "Off" position.

Both can be put on together by moving the switch to the point opposite the "Off," also marked 1, so that the switch covers that point and also that marked 2.

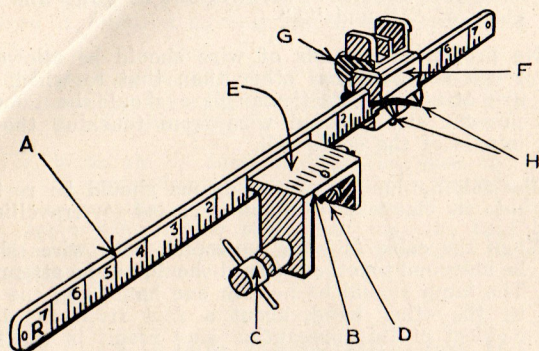
Next to the switch is a block of wood with two holes to take spare bulbs. A hole is cut in the side of the box so that the lid can be closed when the cable is out and the lamps ready for use. Two spare batteries for the lamps are carried in addition to those in the box.

### 2. Instructions for the care and use of Lamps, aiming, M.G.

- i. Before the box is opened, the folding handle of the drum is to be opened out ready for use. This is important, as if the handle is left folded the cable is liable to be pulled away from the connecting screws of the terminal plates of the lamp.
  - ii. When the lamp is not in use, care should be taken to ensure that the switch is left at "Off" and quite clear of "1" and "2."
  - iii. No projecting strands of wire should be allowed to touch any terminal other than that to which they are attached. Particular care should be taken to prevent any exposed wire from touching the terminals of the spare cell.
  - iv. The folding handle of the drums should be restored into its slot when the box is closed for travelling.
  - v. When the cable is being unwound, both wires should be unwound together. Speed should not be attempted. The lamp should be held in one hand; and the wire by the other hand, about a foot from the lamp. Neglect of this precaution may result in the lamp being jerked and the connection carried away should the cable jam on the roller.
- During unwinding, the man at the box should take care that no loose coil of cable is allowed to loop round the ends of the roller.
- vi. When the cable is being wound in, the following procedure is the simplest. The man should hold the body of the box between his knees, turn the handle with his right hand and with his left hand lead the two cables, held as a double cable, regularly across the drum. Regularity in winding-in is essential to ensure that the cable can be instantly unwound when required.
  - vii. The coil of the adjustable resistance should be kept free from knocks and kept in its seating.
  - viii. When in the box, the lamps are placed back to back on two iron pegs. The word "Top" on the lamps indicates the position when on the target post, not when in the box.
  - ix. When the cells are being placed in position it may be necessary to cut the cardboard edge in order to give the ebonite securing strip a good seating on top of the cells.



## FORE-SIGHT, BAR, DEFLECTION, Mk. I.



## SIGHTS, NIGHT.

FORE.

BACK.

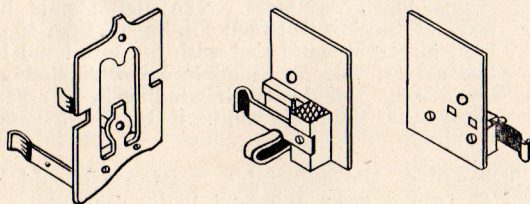


PLATE I.

## CLINOMETER, VICKERS .303-IN. M.G., Mk. I.

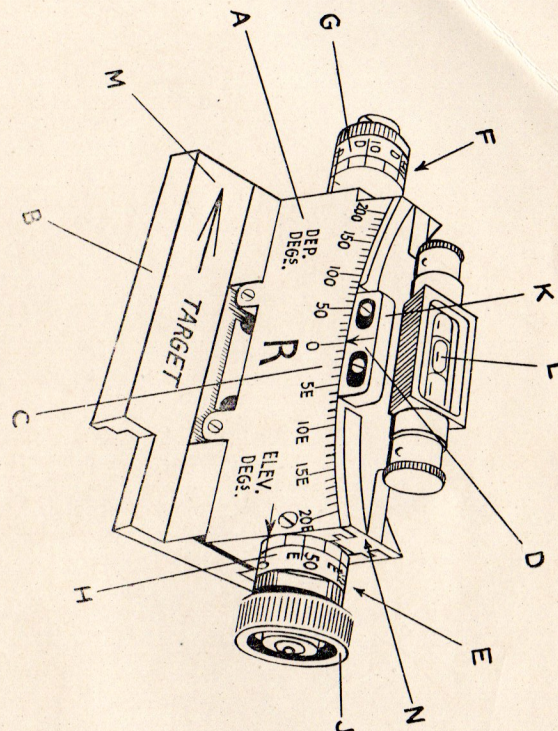


PLATE II.



## Section 4. Stripping—

Lesson 13.	General points .. .. .	27
" 14.	Stripping the gun .. .. .	28
" 15.	Stripping the lock .. .. .	28
" 16.	Stripping— <i>continued</i> .. .. .	30
" 17.	Changing the barrel without loss of water .. .. .	30
" 18.	Stripping component parts .. .. .	31

## Section 5. Spare parts—

Lesson 19.	Description .. .. .	32
" 20.	Packing .. .. .	32

## Section 6. Stoppages and immediate action—

Lesson 21.	First position stoppage .. .. .	37
" 22.	Second position stoppage .. .. .	38
" 23.	Third position stoppage .. .. .	40
" 24.	Fourth position stoppage .. .. .	43
" 25.	Fifth position stoppage .. .. .	43
" 25.	Special stoppages .. .. .	44
" 26.	Causes of stoppages .. .. .	—

## Section 7. Repairs—

Lesson 27.	Repairs .. .. .	46
------------	-----------------	----

## Section 8. Blank firing attachment—

Lesson 28.	Blank firing attachment .. .. .	48
------------	---------------------------------	----

## Section 9. Instruments and aiming—

Lesson 29.	Tangent sight and fixed sight .. .. .	50
" 30.	Dial sight .. .. .	53
" 30A	Bar foresight .. .. .	54
" 31.	Aiming with the dial sight .. .. .	55
" 31A	The clinometer .. .. .	56
" 32.	Direction .. .. .	57
" 33.	Elevation .. .. .	58
" 34.	Recording on the dial sight the quadrant elevation or quadrant angle on the gun .. .. .	59
" 35.	Direction Dial, Mk. II .. .. .	59
" 36.	Elevating wheel .. .. .	60
" 37.	Aiming post M.G., Mk. III, and zero post M.G., Mk. I .. .. .	60
" 37A	Aiming post and zero post, Mk. I .. .. .	61
" 38.	Lamp, aiming, M.G., Mk. III .. .. .	62
" 38A	Night aiming and use of aiming lamp .. .. .	63
" 39.	Directors and angle of sight instrument .. .. .	64
" 40.	Slide rule, M.G., Mk. IV. .. .. .	78
" 40A	Slide rule, M.G., Mk. III .. .. .	79
" 41.	Plotter M.G., and resector protractor, .. .. .	81

## Section 10. Instrument tests—

Lesson 42.	Testing and adjusting the dial sight .. .. .	84
" 42A	Testing and adjusting the clinometer .. .. .	85
" 43.	Testing the director for angle of sight .. .. .	86
" 44.	Testing and adjusting the director No. 9 .. .. .	88









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